EVERYTHING YOU NEED TO KNOW ABOUT Wi-Fi 6

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- SIMPLE STEPS TO BLOCK THE BAD GUYS
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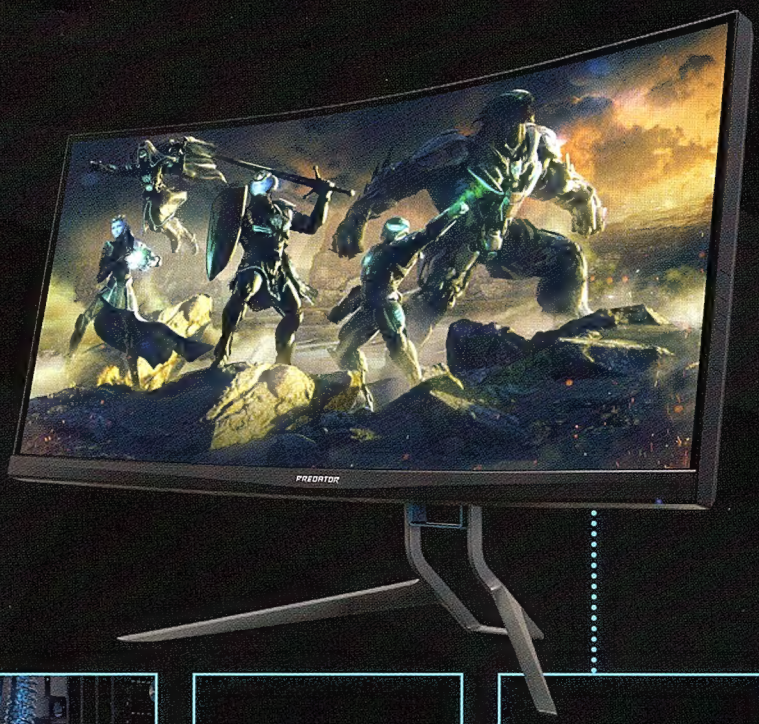

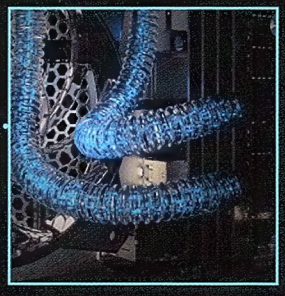

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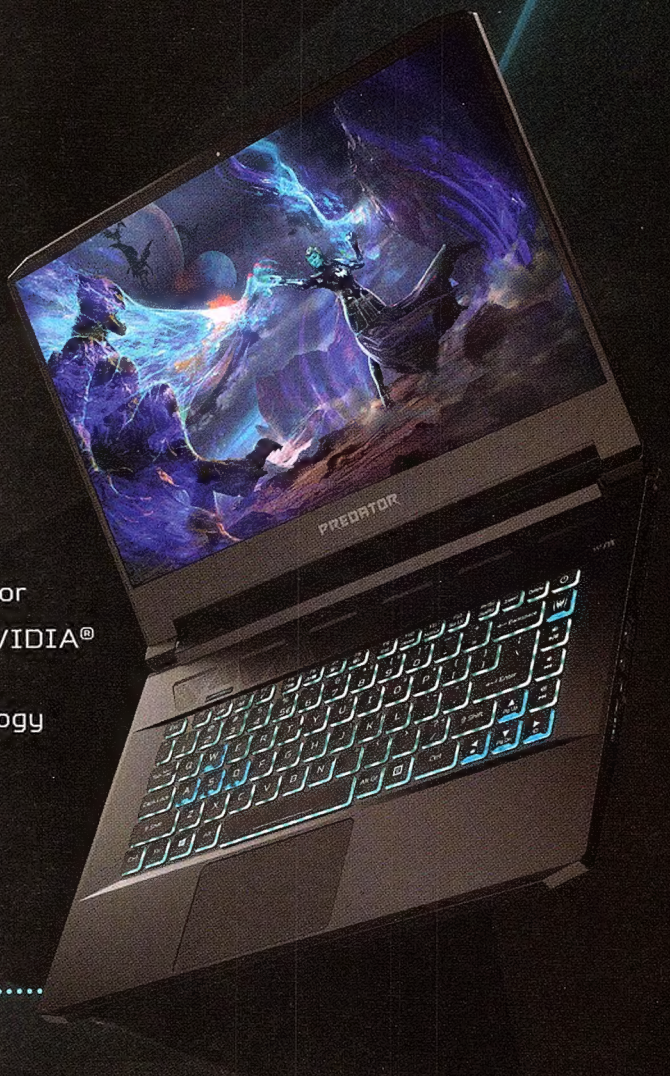

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This one goes to 11

What lies beneath the Surface.

I've just come back from Microsoft's launch event for the new Surface range, and once again the company has dazzled with some really beautiful machines. But the really big takeaway is that the company has crossed some age-old borders and not only launched devices with CPUs from its long-term partner Intel, but also AMD and Qualcomm! This is one of those shifts that will have significant influence and give other system makers confidence to adopt a similar approach.

Now, this is absolutely not a move away from Intel. The 10th-gen Ice Lake CPUs used in the Surface Pro 7 and 13-inch Surface Laptop 3 are high performance and low power parts that fit the Surface's enterprise aspirations perfectly. Ice Lake incorporates Wi-Fi 6, too, and that's going to be an especially big thing with business customers.

But for the larger 15-inch Surface Laptop 3 Microsoft is using a custom AMD 2.3GHz 3rd-gen Ryzen – the 3780U Surface Edition. The reasoning is that this larger screen model will be likely used for gaming more than the smaller Laptop 3, and this Ryzen sports superior RX Vega 11 graphics to handle that job. There's also a budget yet-still-custom 1.3GHz Ryzen model, with Vega 9 graphics.

This represents a notable foot in the door for AMD in the mobile space. Until now AMD hasn't seen much success finding partners willing to use previous AMD processors in laptops. 3rd-gen Ryzen finally delivers the performance, and the Vega GPU has the gaming chops to appeal. It's also fascinating to see AMD create these custom devices. This particular processor has one additional graphics compute unit, for a total of 11 CUs compared to the 10 used in the Ryzen 7 3700U that we think was the template for this custom chip. Besides added performance, there's an obvious marketing edge when Microsoft can say that its Laptop goes to 11 when stacked up against Ryzen 7 3700U-based competitors with 10 CUs. Which is cool and cute and I love it.

And, for the very sexy new Surface Pro X it's driven by a Qualcomm ARM processor – also a custom part designated 'SQ1'. Amazing. This thing is more tablet than laptop and is intended for lighter workloads and being a traveller's friend with its slim and light form, and that you can plug a SIM card into its LTE-enabled body.

It's all fantastic. Intel's 10th-gen Ice Lake CPUs will deliver excellent performance and connectivity, Ryzen will add good graphics power to the mix and the ARM-powered Surface Pro X will, hopefully, sip the juice and be good enough for all but heavy work. We'll have reviews in the next issue, and I can't wait to see how they perform!

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apc

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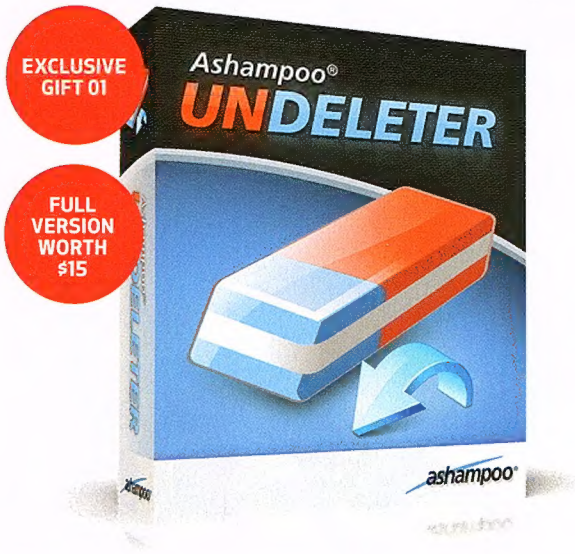

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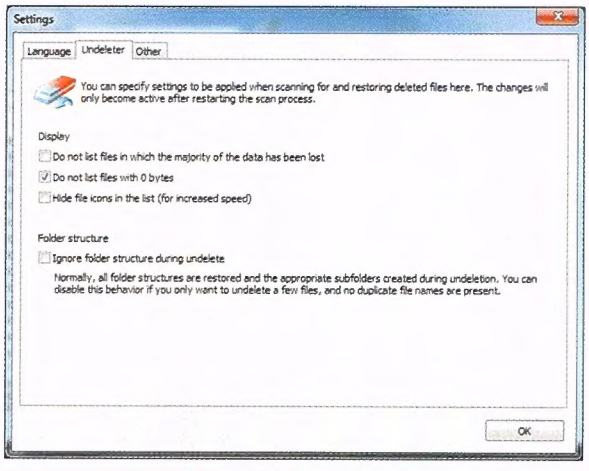
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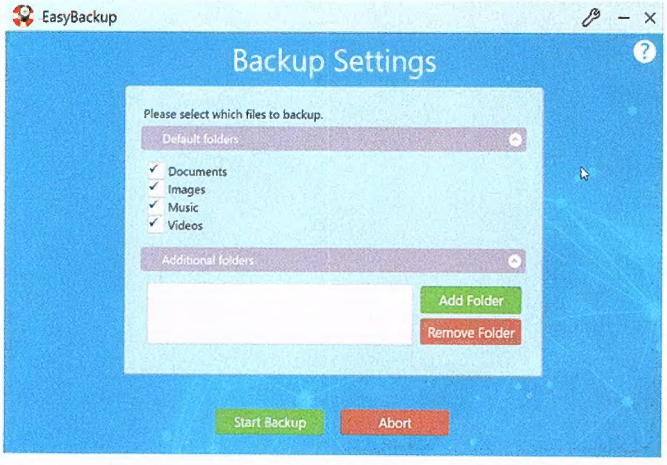

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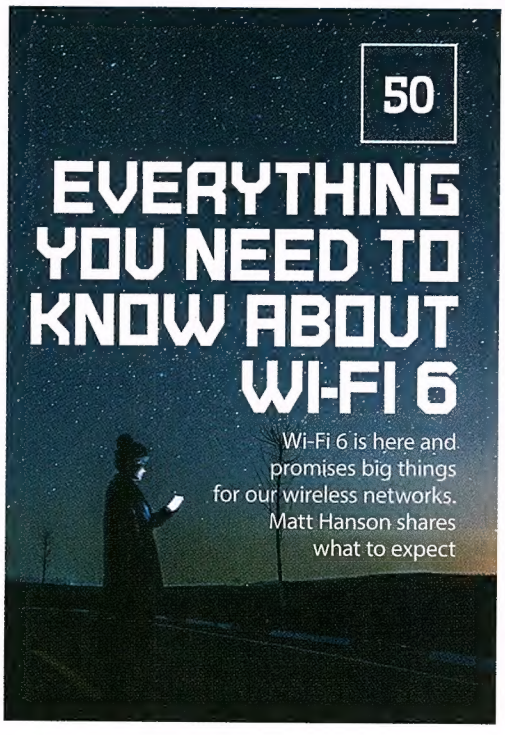

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EVERYTHING YOU NEED TO KNOW ABOUT WI-FI 6

Wi-Fi 6 is here and promises big things for our wireless networks. Matt Hanson shares what to expect

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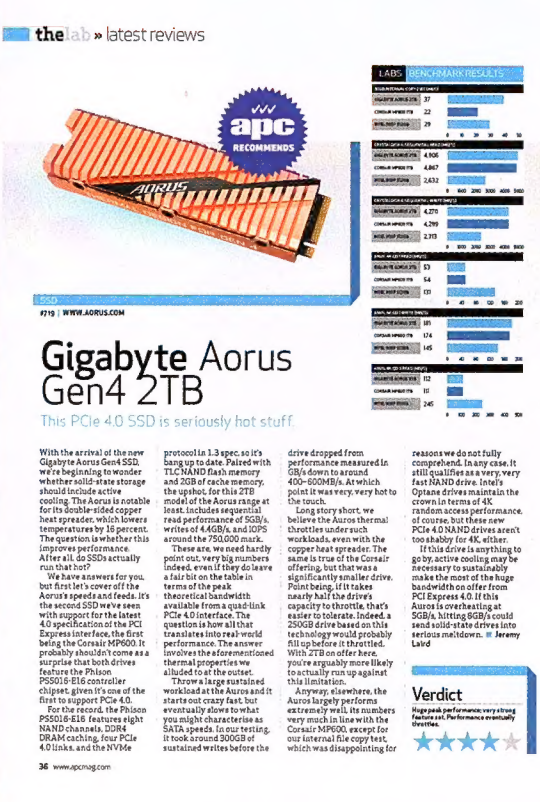

Inside APC

Find out all about *APC*'s editorial policies, test practices, how to read the benchmark results, and more.

APC is Australia's oldest consumer technology magazine – having been consistently in print for over 35 years, since our first issue way back in May 1980 – and we take that heritage and responsibility very seriously. While our focus is obviously on the personal computer – it's in our name, after all – the very definition of the PC has changed and shifted markedly since the early 1980s. As such, we touch on many other areas of tech, too, from smartphones and apps to peripherals, accessories, online services and beyond. We have two main goals: to track down the best of modern tech and also to help our readers make the most of it.

We're also an open church in terms of platforms. We know most people aren't wed to a single brand's products and use a variety of devices. And, like you, *APC*'s journalists want to know what's good in tech – no matter what platform it resides on.

INDEPENDENT REVIEWS

Championing technology doesn't mean we're unrelenting yes-men and -women, however, and *APC* aims to be as objective as possible in all our coverage. That means identifying the best products from multiple perspectives – the best performance, best value and best features and, ideally, the products that offer the best mix of these three.

As a matter of policy, reviews published in *APC* are not shared with product-makers prior to print. We will contact vendors under certain conditions; for example, if we have a problem testing a product that seems to indicate it may be faulty, or to invite a vendor to clarify how a particular feature works. If an *APC* reviewer has any potential conflicts of interest involving a brand, the review will always be assigned to another writer.

LABS TESTING

Despite being a small magazine with limited resources, *APC* still strives to conduct the most rigorous, objective scientific tests and benchmarks we can so as to make our reviews as unbiased as possible. We use a variety of tools and programs for this, including many freely available benchmark suites for assessing media encoding, general system performance, gaming and battery life.

In most cases, for the benchmark results published in *APC*, you can assume that higher is better. There are certain tests that deviate from this rule where the opposite is true; in those cases, we've flagged the results with a note explaining as such.

We use both tables and graphs for displaying results; the latter are our preference due to their ease-of-readability, but tables are more compact, so we use these in cases where thoroughness is preferred.

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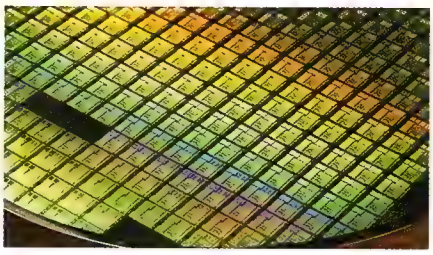


TSMC's sales to skyrocket

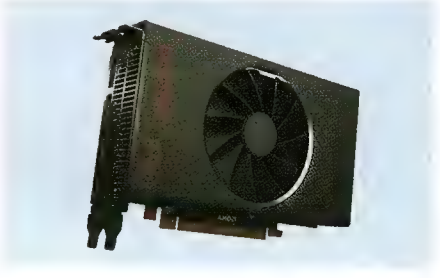
7NM STAIRWAY TO HEAVEN.

Semiconductor market research firm IC Insights has predicted that chip maker TSMC's sales would jump 32% year-over-year in the second half of 2019. The firm expects the rest of the integrated circuit market's sales to rise by 10% in that same period, meaning that TSMC could experience growth at over three times the rate of the rest of the market. Much of that extra growth can be attributed to the popularity of AMD CPUs made with its 7nm process.

Microsoft's OneDrive Personal Vault now available globally

SUPER-SECURE AND FREE.

Microsoft has rolled out the new secure cloud storage feature, OneDrive Personal Vault, to users around the world. First announced back in June, Personal Vault is designed as somewhere to store sensitive files.The feature adds a secure storage folder to OneDrive accounts which are protected by two-factor authentication – either a fingerprint, face scan, extra PIN, or secure code sent out via email or SMS, in addition to a regular password.



AMD announces Radeon RX 5500

1080P GAMING FOR DESKTOP AND MOBILE.

AMD announced the next series in its Radeon RX 5000 family of video cards, the Radeon RX 5500 series. Based on the same RDNA architecture as AMD's flagship RX 5700 parts, the new RX 5500 series is being built around a new, smaller Navi GPU that will allow AMD to bring their latest Radeon technologies down to more affordable, mainstream video cards, as well as laptops for the first time.

Intel's 10th-gen Cascade Lake-X HEDT CPUs

UP TO 18-CORES, HALF THE PRICE OF 9TH-GEN.

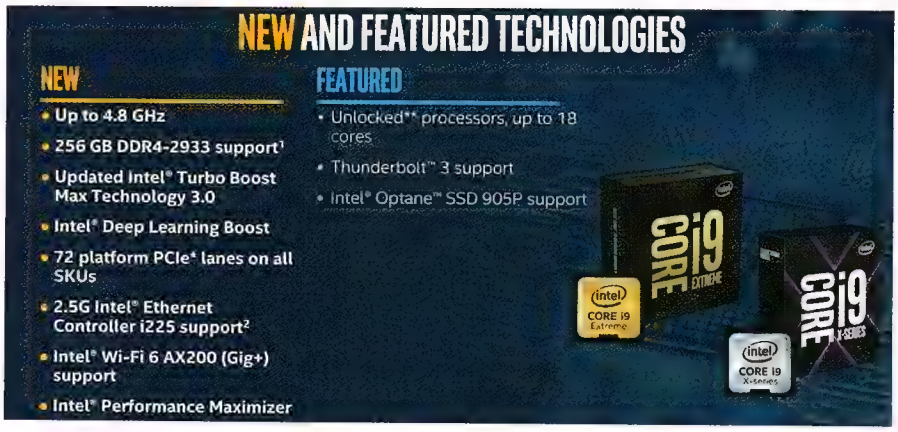
Intel has lifted the lid on its upcoming Cascade Lake-X family of processors for the high-end desktop market (HEDT). Similar to the way Intel's Cascade Lake based Xeon Scalable processors are a further revision of their Skylake Xeons, offering clock speed increases and security fixes in hardware, the new HEDT processors will grant higher frequencies, more memory capacity, and better protection against side-channel attacks. The key numbers however are the big drop in Intel's pricing: Intel will be releasing its 18-core part, the Core i9-10980XE, for under US$1,000.

This pricing is a significant shift in Intel's strategy, and there can be little doubt that AMD made this happen. AMD is set to launch its 16-core Ryzen 9 3950X at US$749, which will offer 16 PCIe 4.0 lanes for slots (+4 for M.2, +4 for chipset) and support for 128GB of DRAM. So Intel needed something similarly speedy, but with more PCIe lanes and more memory support that it could offer for just a bit more, leading to the 10980XE for US$979.

All the CPUs will support 256GB of quad-channel memory (up from 128GB), and have 48 PCIe 3.0 lanes (up from 44). Memory speed support is listed as DDR4-2933 for one DIMM per channel, and DDR4-2666 for two DIMMs per channel. All these CPUs have a TDP of 165 W, which Intel states will help the CPUs to turbo longer under Intel's recommended settings. All these CPUs are supported in X299 motherboards.

The company is bringing new networking tech to the desktop with its i225-V controller for 2.5Gbps Ethernet, while its AX200 module slots in for Wi-Fi 6 wireless connectivity. Coincidentally, those are two technologies that chief competitor AMD does not have as in-house IP, adding to Intel's value proposition.

There is no 16-core in this stack, with Intel's official reasoning being that they assess the market with each generation and they don't believe there's a suitable price point for such a part when the 14C and 18C parts are so close. Many will point the finger and say that no 16 core Intel part means no direct comparison with the Ryzen 9 3950X. Intel's Cascade Lake-X processors will be available in November.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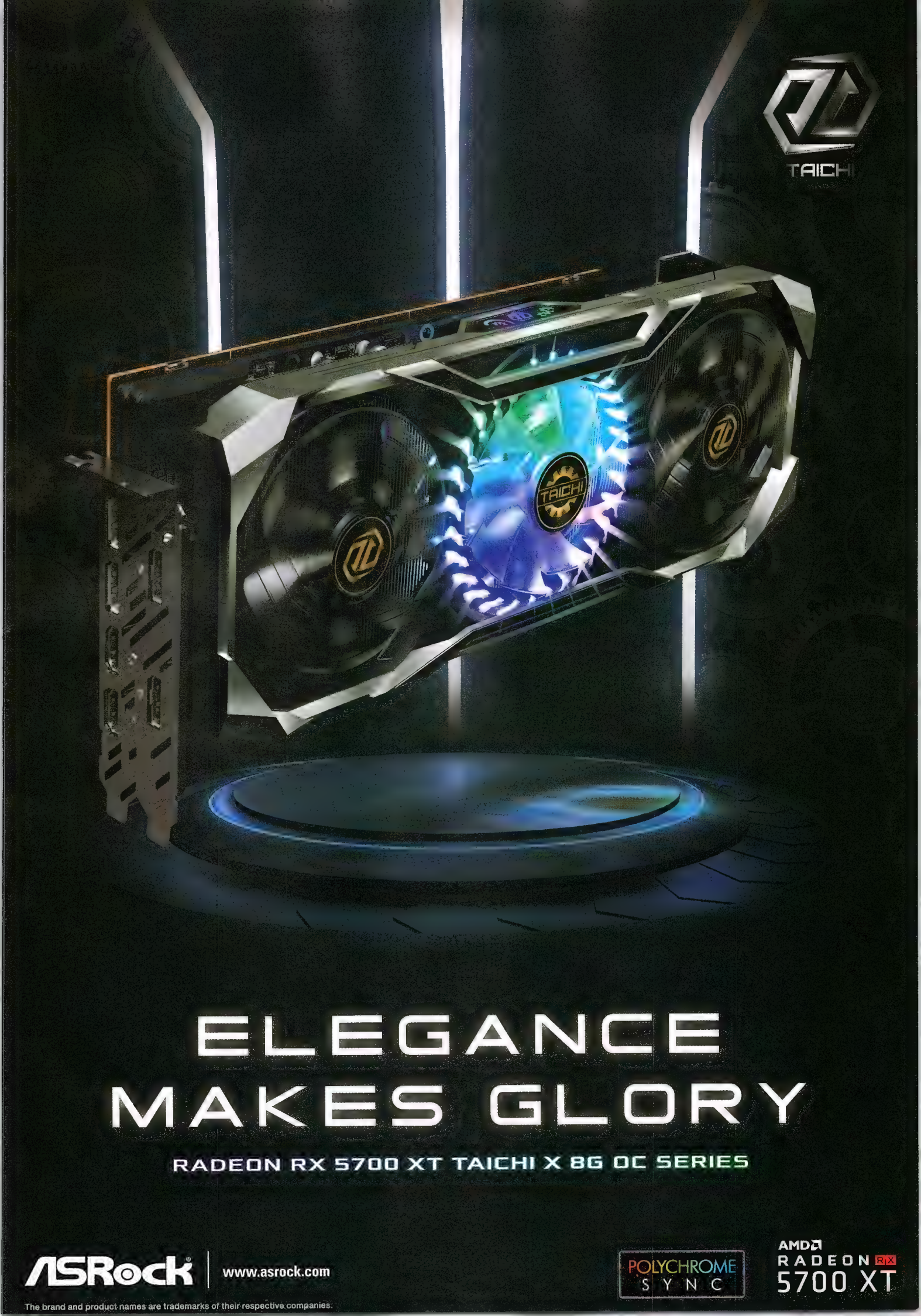
2.5G Intel® Ethernet Controller i225 support[2]
Intel® Wi-Fi 6 AX200 (Gig+) support
Intel® Performance Maximizer
FEATURED
Unlocked** processors, up to 18 cores
Thunderbolt™ 3 support
Intel® Optane™ SSD 905P support
CORE i9 EXTREME
CORE i9
CORE i9 X-SERIES

INTEL CASCADE LAKE-X

ANADTECH	CORES THREADS	BASE	ALL CORE	TB2	TB3	TDP	PRICE (USD)
CORE I9-10980XE	18C / 36T	3.0	3.8	4.6	4.8	165 W	$979
CORE I9-10940X	14C / 28T	3.3	4.1	4.6	4.8	165 W	$784
CORE I9-10920X	12C / 24T	3.5	4.3	4.6	4.8	165 W	$689
CORE I9-10900X	10C / 20T	3.7	4.3	4.5	4.7	165 W	$590
SKYLAKE-X (PREVIOUS GENERATION)							
CORE I9-9980XE	18C / 36T	3.0		4.5	4.7	165 W	$1,979
CORE I9-9940X	14C / 28C	3.3		4.5		165 W	$1,387
CORE I9-9920X	12C / 24T	3.5		4.5		165 W	$1,189
CORE I9-9900X	10C / 20T	3.5		4.5		165 W	$989



ELEGANCE MAKES GLORY

RADEON RX 5700 XT TAICHI X 8G OC SERIES

ASRock | www.asrock.com

POLYCHROME SYNC

AMD RADEON RX 5700 XT

The brand and product names are trademarks of their respective companies.

Your iOS browser could be sending tracking data to China

LATEST VERSION OF SAFARI SENDS SAFE BROWSING DATA TO TENCENT.

By examining Safari's Fraudulent Website Warning disclaimer, users discovered that iOS 13 (and possibly other versions of iOS starting at 12.2) sends data to Tencent Safe Browsing in addition to Google Safe Browsing, where it helps protect users from phishing scams. The disclaimer states that "these safe browsing providers may also log your IP address", but it's not strictly clear whether Tencent collects any information on users outside of China.

Google Chrome is working on a new feature to freeze background tabs

YOUR RAM COULD FINALLY BE SAVED!

Google is testing a new feature for Chrome that lets the browser 'freeze' tabs that have been running in the background to free up memory. Tab Freeze is available to test in Chrome 79 Canary, the browser's developer beta for feature testing. To give it a try, visit **chrome://flags/#proactive-tab-freeze** and select one of the options from the drop-down menu.

Windows 10 update breaks Edge and Start Menu for some users

WHILE MACOS CATALINA IS CAUSING USER EMAILS TO GO MISSING.

The Windows 10 May 2019 Update continues to be plagued by problems, with update KB4517389 breaking the Edge browser for some users, leaving them unable to open it, which is in addition to the Start Menu being unable to operate for some. Meanwhile, macOS Catalina is in similar strife, with users updating to the latest version of the OS reporting that their emails have completely disappeared in the native Mail client.

Microsoft unveils new Surface Laptop and Pro lineup

AND PREVIEWS DUAL-SCREEN DEVICE FOR 2020 LAUNCH.

The company has launched new Surface devices, including the Surface Laptop 3 in both 13.5 and 15-inch configurations, as well as the Surface Pro 7. It also showed off devices for next year, the foldable Surface Neo and a Surface Duo Android phone. The Surface Laptop 3 has a 20% larger touchpad with a machined aluminium finish. It uses both USB Type-C and Type-A ports and will come in 13.5-inch and 15-inch versions. The Surface Laptop 3 features fast-charging over Surface Connect and a removable hard drive. The biggest news is that the 15-inch model will use AMD Ryzen 7 Surface Edition (custom silicon for this product only) with Radeon RX 11 Graphics.

Microsoft said the 13-inch Surface Laptop 3 will use a quad-core Intel Ice Lake CPU, making it twice as fast as the existing Surface Laptop 2.

For the new Surface Pro 7, the beloved tablet is finally getting USB Type-C. Microsoft is also bringing pen support to Excel. The top-line Surface Pro X includes an LTE module. The new Surfaces will be available through October and November. We'll have full reviews in the next issue.

"The biggest news is that it will use AMD Ryzen 7 Surface Edition (custom silicon for this product only) with Radeon RX 11 Graphics."

Mastercard and Visa pull support for Facebook Libra

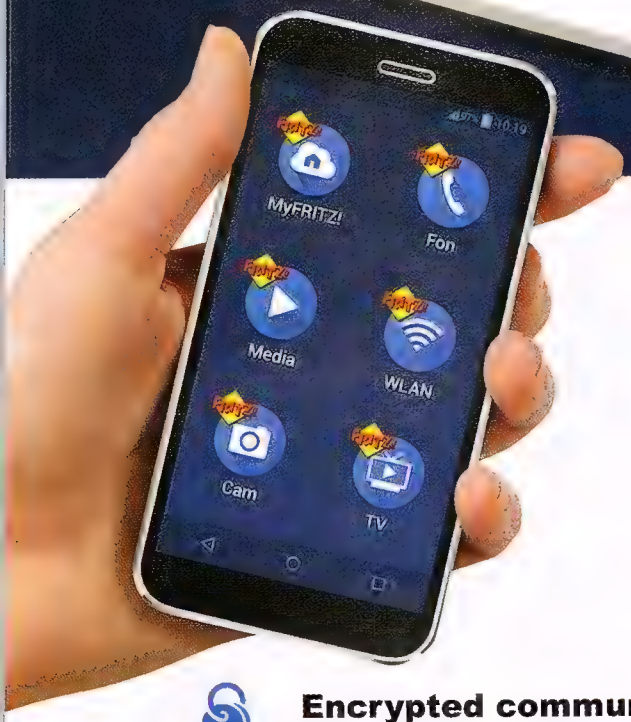
SHORTLY AFTER EBAY, PAYPAL AND STRIPE DID THE SAME.

Mastercard and Visa have become the latest backers to withdraw their support for the Facebook Libra cryptocurrency, which looked to offer a new way of paying friends, family and businesses. The news comes shortly after PayPal also announced it would be pulling its backing for Libra, with eBay and Stripe also dropping out recently. Facebook is set to launch both Libra and its Calibra digital wallet next year, but has been tight-lipped on what form both offerings will actually take. It has said it won't launch Libra until all of the regulatory issues are addressed. Libra revealed 28 major firms as launch partners back in June, who were meant to assist with governing the project, although many of these have pulled out as the project has come under fierce scrutiny from lawmakers around the world. Facebook CEO Mark Zuckerberg is set to appear before the US house committee on financial services to answer questions on Libra.

Quality entertainment around the clock
Enjoy great entertainment throughout the entire home network.
Keep everything as simple as possible

GERMAN DESIGN AWARD WINNER 2018

AVM Fritz!Box 7590
Made in Germany



FRITZ!Apps for iOS and Android

Encrypted communication via VPN

Smart WiFi technology Multi-User MIMO

At home anywhere with MyFRITZ!

Two wireless networks for more flexibility

Answering machine with voice to mail

Band steering: smart band selection convenience

Ready for the future with IPv6

Mesh WiFi with FRITZ! enjoy full mesh networking

Connected in no time with WPS (Wi-Fi Protected Setup)

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techbrief

» A DEEPER LOOK WHAT'S TRENDING IN TECH.

Quantum shown to be faster than classical computers...

...while Google claims 'quantum supremacy' with 53-qubits. Arne Verheyde & Lucian Armasu examine progress on the quantum front.

In a new scientific publication, Google claims to have reached "quantum supremacy" with a 53-qubit quantum computer, meaning that it has solved a problem that no classical computer can solve within a reasonable timeframe. It is the first time this has been achieved, marking a major milestone in the field of quantum computing.

While the term supremacy is a bit of an exaggeration, as it concerns just one application, it shows that quantum computers with their qubits, albeit still years from commercialisation in all likelihood, have finally reached a point where they have solved a problem that no transistor-based computer or supercomputer could ever solve, essentially proving that quantum computers indeed work. "To our knowledge, this experiment marks the first computation that can only be performed on a quantum processor," the Google researchers wrote.

The experiment involved calculating the output of certain specialised circuits, with as input randomly generated numbers "produced through a specialised scenario involving quantum phenomena." The quantum processor took 200 seconds to sample one instance of the quantum circuit one million times, while a supercomputer would require 20,000 years to perform that task, according to the researchers. The quantum computer used was Google's 53-qubit Sycamore system, scaling back from their 72-qubit Bristlecone machine, although no reason was provided.

The researchers further predict that quantum computing power will grow at a double exponential rate, possibly referring to the exponential growth in capabilities with each new qubit, but with the number of qubits growing at an exponential rate akin to Moore's Law.

Not too long ago, quantum computers belonged largely to science fiction. But in recent years, several companies have made progress in scaling up the number of qubits, including Google, IBM, Microsoft, and Intel. Last year, IBM already proved that quantum computers could be superior to classical ones for a certain problem, while Intel unveiled its 49-qubit Tangle Lake quantum computer at CES 2018.

A section of an IBM quantum computer. Already leaps and bounds ahead of classical computers, at least in the beauty stakes.

Meanwhile, IBM researchers have published a paper proving that quantum computers can indeed be faster than classical computers, something that has only be theorised so far. One of the main promises of quantum computers has been that they can solve complex problems much faster than classical computers can. Classical computers typically require exponentially more resources and power as the number of variables increase.

IBM was able to prove, for a specific difficult algebraic problem, that quantum computers need only a fixed number of steps to solve the problem, even as the number of inputs increases. This makes the quantum computation much more efficient than the classical counterpart. The more complex the problem becomes, the more efficient the quantum computed solution should be too.

The IBM researchers Sergey Bravyi, David Gosset and Robert König said in their paper:

"We show that parallel quantum algorithms running in a constant time period are strictly more powerful than their classical counterparts; they are provably better at solving certain linear algebra problems associated with binary quadratic forms. ■

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» GIZMOS AND GOODIES.

PLANTRONICS BACKBEAT PRO 5100

Lightweight, true-wireless earbuds that listen to you.

$299 | PLANTRONICS.COM

There are a lot of true wireless earbuds out there, and while many are great for audio quality, with some even featuring active noise cancelling, very few are any good at taking phone calls. Plantronics has a long history of designing communication headsets and have drawn on these roots by designing the BackBeat Pro 5100s with four noise-cancelling microphones that are particularly adept at removing wind and other background noise from calls, to boost voice audio quality. This vocal clarity also provides better audio recognition by your digital assistant, for anyone who would rather not have to take their phone out in order to check something.

SONOS MOVE

A Wi-Fi speaker that isn't afraid to get outdoors.

$649 | SONOS.COM

As a pioneer of the home Wi-Fi speaker, a Bluetooth speaker might not seem like the perfect fit for Sonos, but the Move manages to make itself great both at home and abroad. On its ring-shaped charging base the device acts like a wall-powered Wi-Fi speaker that slots neatly into your existing Sonos Wi-Fi speaker setup. If you do, however, show it the door the system offers 10 hours battery-life over Bluetooth, splash/dust protection and features a wide-angle low-frequency deflector to spread the perfect listening position in open spaces. It also pioneers onboard SoundSense tech to auto calibrate the playback for whatever room it's placed in.

SURFACE EARBUDS

True-wireless buds that delve a little deeper into productivity features.

US$249 | MICROSOFT.COM

Microsoft's Surface Headphones were a hit last year and so the company is backing it up with a pair of true-wireless Surface Earbuds. The main focus is again audio quality, with the new headphones aiming to deliver a rich audio experience, but the Surface Earbuds are also bringing a suite of Office 365 integrations that'll appeal to the productivity focused customers. In addition to offering Cortana as your assistant of choice, the headphones will read and reply to your Outlook inbox using voice to text or add Powerpoint comments and move through slides using the Earbud's touch controls.

SEAGATE ONE TOUCH SSD

A decent performing SSD with some sweet bundles.

$119 (500GB), $229 (1TB) | SEAGATE.COM

Yet another portable drive that has fashion aspirations, Seagate's One Touch SSD is fabric-lined and relatively small, around the size of a credit card (though not in height, of course, it measures 10mm there). You can have black or white, or a choice of four camo patterns. Seagate claims 400MB/s maximum sequential read and write speeds, so that's on par with an internal SATA SSD, not bad. Connectivity is via USB 3. Sync Plus software is included for automatic backups whenever it's connected, and Seagate's throwing in a complimentary two month Adobe Creative Cloud subscription, as well as a one year sub to the photography service Mylio Create.

TRUSENS AIR PURIFIER

Saving your lungs with science.

FROM $229 | TRUSENS.COM

Air purifiers are a booming business right now, as the thought of sitting inside for hours breathing all sorts of wretched particles rises in our marketing-driven consciousness. But a good one makes a big difference. The very new TruSens has you place a sensor across the room from the main unit, with both measuring air quality. This provides the machine with better data for your room, and the machine adjusts its operation based on how mucky your air is. An app lets you fiddle more. A washable pre-filter gets the big stuff, and replaceable carbon and HEPA filters capture the smaller particles. The center core has a UV lamp to kill off microbes.

ATEN 2-PORT USB-C DOCK SWITCH WITH POWER PASS-THROUGH

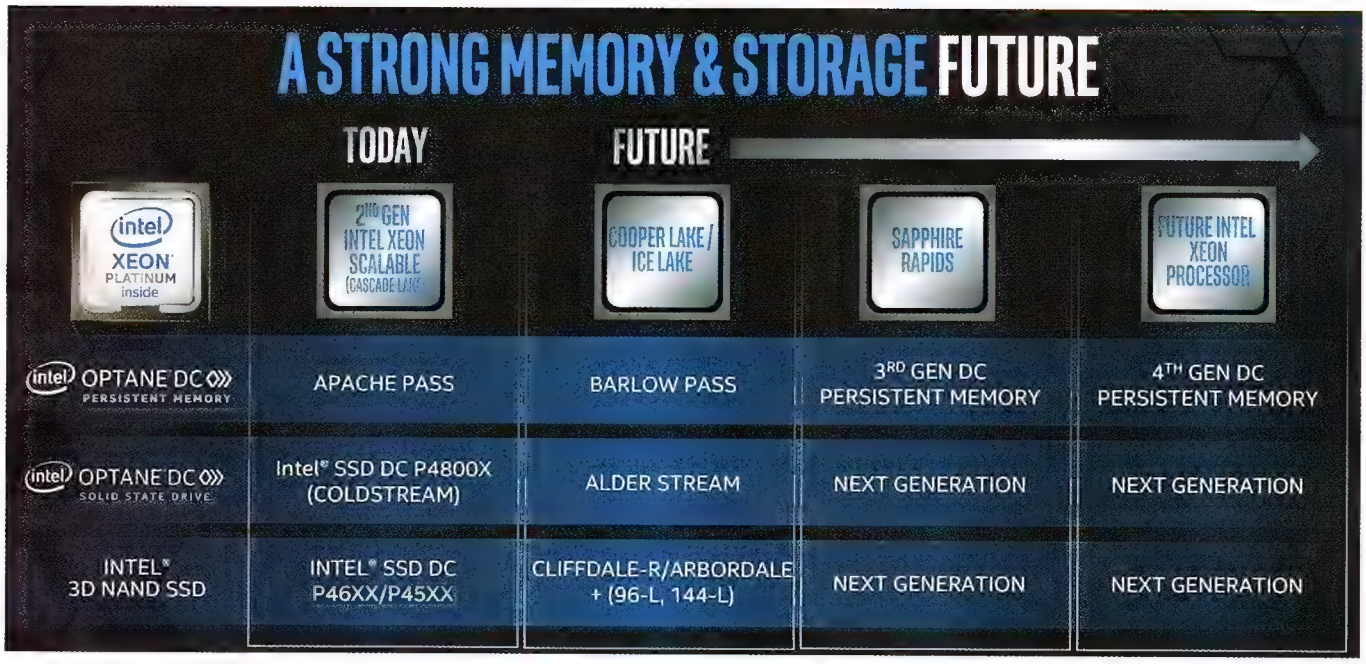
A powered KVM switch for your phone and laptop.

$329 | ATEN.COM

Aten, a maker of professional AV gear, occasionally drops a consumer device and they're always impressive. To this you connect a PC or Mac laptop together with a phone or tablet, both via USB-C, and an HDMI monitor (up to 4k supported), then hit the little corded switch and the display, mouse and keyboard control switches between each. Just like a Samsung DeX, but for any USB-C phone, as long as it supports DP Alt Mode for video out. Around the front is a pair of USB 3.2 ports for the mouse and keyboard, or attached storage. As the too-long name implies (it's model US3310 if you want to order one), the device is sufficiently powered to charge both the phone and laptop as you work. Very useful indeed! ■

twobits

» CHRIS SZEWCZYK'S THOUGHTS, EXPERIENCES AND JOURNEYS THROUGH THE WORLD OF TECH.



Don't ever write off Intel

Revolutionary tech is coming. That's revolutionary with an R.

2019 has been the year of AMD. Desktop Ryzen and enterprise Ryzen Pro, along with Navi GPUs have been the big tech highlights of the year. Probably sick of being off the front page, Intel has been taking steps in recent months to tell the world (that is, the tech media) that it isn't going anywhere and to keep an eye on it in 2020 and beyond. We attended a recent tech day in South Korea where we were given a look at some of the things Intel is working on with regards to its storage products.

With 10nm products yet to really see the light of day, there's not a huge amount to talk about with regards to new CPU architectures and process technology. We want to see something new, something cool, something awesome, and maybe we have it with the revelation of new Optane technologies.

I've personally been a fan of Optane for some time. The problem has been the messaging behind it. Optane SSDs offer blazing fast response times and I/O and they can have a measurable effect when used as a cache drive with a HDD. The problem has been is that Intel doesn't include Optane support on its cheapest chipsets. To really succeed as a cache drive, even the lowly H310 chipset needs Optane support. These users are the ones most likely to be using a HDD.

What's really exciting is Optane persistent memory, which is memory that retains data when it is powered down, unlike traditional DRAM. This kind of tech has some really amazing promise, though for now it is limited to the data centre. Think of something like rebooting a database. There's a reason your internet banking goes down for several hours most weekends. It's not necessarily to fix something that's broken; a lot of it is the time it takes to reboot something that large from storage!

> "Probably sick of being off the front page, Intel has been taking steps in recent months to tell the world that it isn't going anywhere."

It essentially combines the best properties of Optane storage, with closer-to-the-CPU DRAM. It elevates storage one step up the data pyramid. On-die caches will always be the fastest, followed by DRAM and then storage with mechanical drives at the bottom. The end result is faster computing, with better response times, faster application loading and boot times. Sounds great!

The problem is, for now, this technology is *very* expensive. We might see it trickle down to workstation class products in the following years, but for now, Intel remains tight lipped about whether we will see persistent memory make it to the desktop.

Intel is also gearing up to launch new SSDs including the 665p, a new 96 layer QLC NAND drive that should theoretically bring down the dollars per gigabyte ratio even further, all but eliminating hard drives from notebook class devices.

We were also teased with second generation Optane products, though there is some time to go until they launch. Codenamed Alder Pass, these products could end up making existing Optane drives look positively sluggish. Will we see an enthusiast class 512GB or 1TB 2nd generation Optane drive? Though it would never be called cheap, and NAND drives would have nothing to worry about, such a device would be fast. Very fast. Yes I would take two. ■

enduser

» SHAUN PRESCOTT DIGS INTO THE BIG TECH ISSUES.

Blizzard has stepped into a cultural battle it cannot win

The company's punishment of a pro-gaming Hong Kong supporter rustled millions of feathers, writes Shaun Prescott.

It's hard to tell if Blizzard knew how much crap it was stepping into. In mid-October, *Hearthstone* pro gamer Chung 'Blitzchung' Ng Wai gave an interview during a *Hearthstone* Grandmasters tournament stream, during which he donned a gas mask and goggles, and then shouted "liberate Hong Kong, revolution of our age!". He was suddenly disconnected from the stream, and hours later, Blizzard announced that the pro would be suspended from competitive *Hearthstone* for 12 months, and that his prize money would be forfeited. This punishment was meted out in keeping with its *Hearthstone* Grandmasters competition rules, which forbid engaging in any act that "in Blizzard's sole discretion, brings you into public disrepute, offends a portion or group of the public, or otherwise damages Blizzard's image..."

This elicited an outpouring that no one expected. Hong Kong has been awash in protests, sometimes violent, for the better part of this year. Initially prompted by a new amendment bill which would allow the extradition of criminals to mainland China, it's quickly evolved into a broader battle between Hong Kong's democracy and China's authoritarianism.

At least, that's the best way to read the vicious response to Blizzard's move. Social media powerfully condemned Blizzard, as did a handful of employees of the California company. A lot of the criticism stems from the perception that Blizzard seeks to appease China, free speech be damned: not only are some of its games popular in China, but Chinese entertainment behemoth Tencent owns a five percent stake in the company. Alienating China risks having its games unceremoniously pulled from the region, which isn't ideal since around 12 percent of Blizzard's revenue comes from Asia-Pacific.

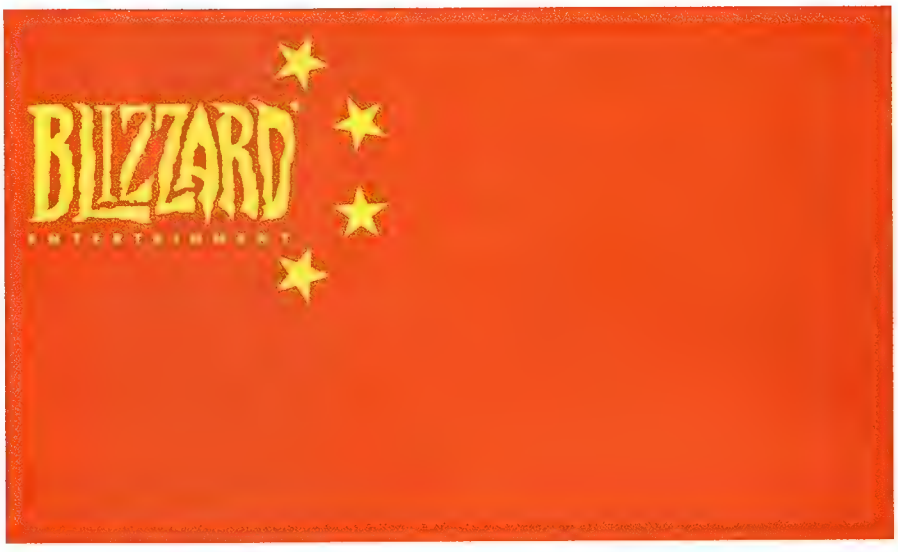


IMAGE: REDDIT

Of course, capitalism's usually tonedeaf profit motive rarely yields: no amount of free speech crusading and anti-China sentiment among western gamers is going to compel Blizzard to step away from that 12 percent revenue. And if it was any other gaming company perhaps the anguish would have been milder, because Blizzard has been awash in an (admittedly milder) PR disaster for over 12 months now.

This time last year, remember, the announcement of a new *Diablo* smartphone game at BlizzCon was met with widespread aggrievement. With its steadfast PC-owning user base already feeling disenfranchised, it's no surprise that Blitzchung's suspension was met with such a conflagration.

Was Blizzard in the wrong? Perhaps it quietly believes so: it later reduced Blitzchung's suspension to six months, and agreed to reward him his prize money. But unemotionally speaking, it's hardly Blizzard's fault that it seeks to make bank in one of the biggest markets in the world, and with the rapid ascent of China in general, it's a moral / ethical quandary that will keep happening, probably with increasing regularity. No amount of lip service – whether it be major brands cashing in on progressive causes, or tech companies greenwashing their products – can change the fact that capitalism is an inherently cold business. No doubt many, if not most, of the people working at Blizzard feel conflicted about the ordeal, but modern capitalism permits no colour gradations. ■

END USER

Share your stories!

If you have an interesting story about technology users, their experiences and the issues that affect us all (whether funny or serious), email us at **apcmag@futurenet.com**. All correspondence becomes the property of *APC* and is subject to editing. Letters must include writer's full name, street address, suburb, state and phone number to be considered for print publication. Address and phone details will not be published.

» JOEL BURGESS STEPS INTO THE FRAY.

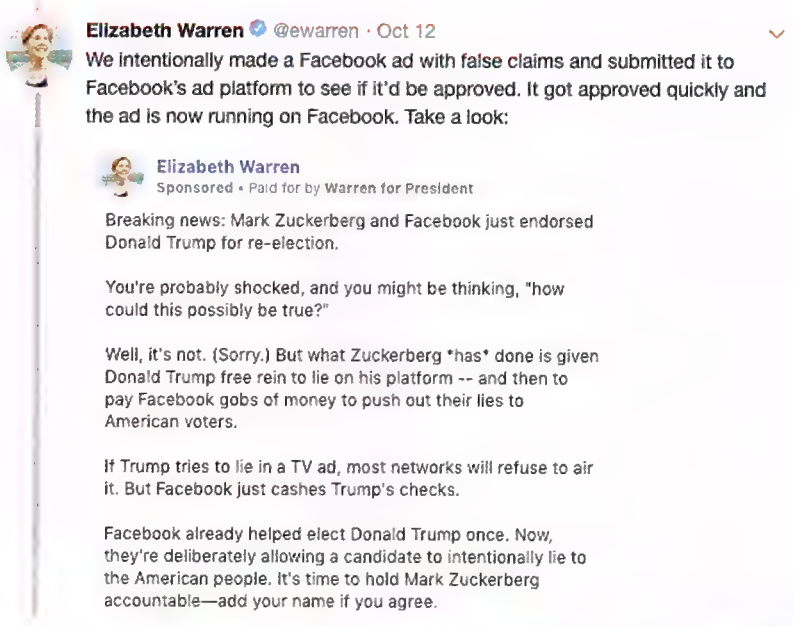
Facebook says lying in ads is fine, as long as you're a politician

The pervasive social media giant may have just broken any possible future trust in democratically elected governments, says Joel Burgess.

Early in October, Judd Legum from Popular Information reported that Facebook amended its Advertising Policy to be less restrictive about ads that contain 'misinformation'... particularly when they come from elected government representatives or budding political candidates. Previously, Facebook would have been bound by its policies to remove ads containing any "deceptive, false or misleading content", but the new policy significantly limits this by only banning ads that have been "debunked by third-party fact checkers". What's more dramatic, however, is that the new policy exempts any "political figures" from these 'Misinformation' restrictions altogether, allowing elected officials and candidates to use patently false information in as many ads as they want.

This rollback on false advertising policies happened to coincide with a US$1.5 million dollar increase in Facebook ad spending from Trump's re-election campaign and the new policies were clearly in force on October 1st, when a Trump-endorsed ad went live, claiming that "Joe Biden promised Ukraine $1 billion dollars if they fired the prosecutor investigating his son's company". Since at least two of Facebook's approved third party fact-checking organisations, *Politifact* and *Factcheck.org*, have reviewed this ad and deemed that its assertions were unequivocally false it's clear that the company intends to stand by its new policies.

The following week, Democrat and American presidential candidate, Elizabeth Warren, attempted to put Facebook in a corner by using the new false advertising service to say that "Mark Zuckerberg and Facebook just endorsed Donald Trump for re-election". While you could probably argue that this is a more accurate representation of underlying political allegiances, Mark Zuckerberg and Facebook did not publicly endorse Trump for re-election, yet this ad was published (unedited) by the social media company. This ad will have been seen by millions of people, with the vast majority taking it at face value. By allowing political ads with objectively false information to run, Facebook has the potential to change the entire democratic landscape into one where the only important factor in your campaign is how well you can lie and get away with it.


Elizabeth Warren @ewarren · Oct 12
We intentionally made a Facebook ad with false claims and submitted it to Facebook's ad platform to see if it'd be approved. It got approved quickly and the ad is now running on Facebook. Take a look:
Elizabeth Warren
Sponsored · Paid for by Warren for President
Breaking news: Mark Zuckerberg and Facebook just endorsed Donald Trump for re-election.
You're probably shocked, and you might be thinking, "how could this possibly be true?"
Well, it's not. (Sorry.) But what Zuckerberg *has* done is given Donald Trump free rein to lie on his platform -- and then to pay Facebook gobs of money to push out their lies to American voters.
If Trump tries to lie in a TV ad, most networks will refuse to air it. But Facebook just cashes Trump's checks.
Facebook already helped elect Donald Trump once. Now, they're deliberately allowing a candidate to intentionally lie to the American people. It's time to hold Mark Zuckerberg accountable—add your name if you agree.

> "This ad will have been seen by millions of people, with the vast majority taking it at face value."

If we take a step back to the 2016 election where the Trump campaign worked closely with Cambridge Analytica and Facebook to direct advertising to impressionable individuals in sway districts to win key political electorates, it's obvious just how important Facebook ads are to the Trump campaign. The Cambridge Analitica data breach used 50 million harvested Facebook profiles to create a statistical dataset of the interests, vulnerabilities and bugbears of the entire US population – a dataset that basically allows you to send tailored political ads to each and every voting candidate on the issues they care most about. Cambridge Analytica director-turned-whistleblower Brittany Kaiser has described this dataset as a tool that meets all the official requirements to be classified as a "weapons-grade communication technique" for waging information warfare. If you combine this dataset (which we're assuming the Trump campaign still has) with the ability to blatantly lie in advertisements... we're not sure the democratic process of electing a government is actually robust enough to continue to function, at least in any traditional sense. ■

numbercrunch

» WE LOOK AT THE NUMBERS DRIVING THE BIG TECH NEWS.

60%

of new passwords are secure against guessing attacks – meaning it would take an attacker over a hundred million guesses before identifying the correct password – according to figures from Google Password Checker.

is the number of cassette tapes predicted to be sold by the end of 2019, in an unlikely uptick for the dreadful old format. 50,000 were sold in 2018, accounting for 0.2 percent of album sales. A return to software sales on cassette remains unlikely, but we'll keep you posted.

Uber US$5 BILLION

is the amount of money lost by ride-sharing firm Uber in the three months to June 2019, the biggest loss in its history. The company, valued somewhere north of US$80 billion, has never made a profit.

10

The version number of the latest release of phone operating system Android, despite being the 15th named version since the OS came out of beta in 2009. The idea of jumping to 10 is very popular, with Windows 10 being around the 19th released version of Microsoft's OS, depending on how you count them.

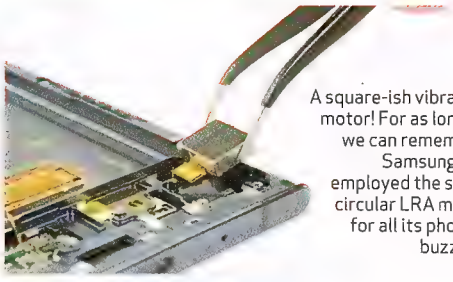
3%

of Brits surveyed answered 'don't know' when the question 'Have you ever tried surfing' was posed to them by YouGov.

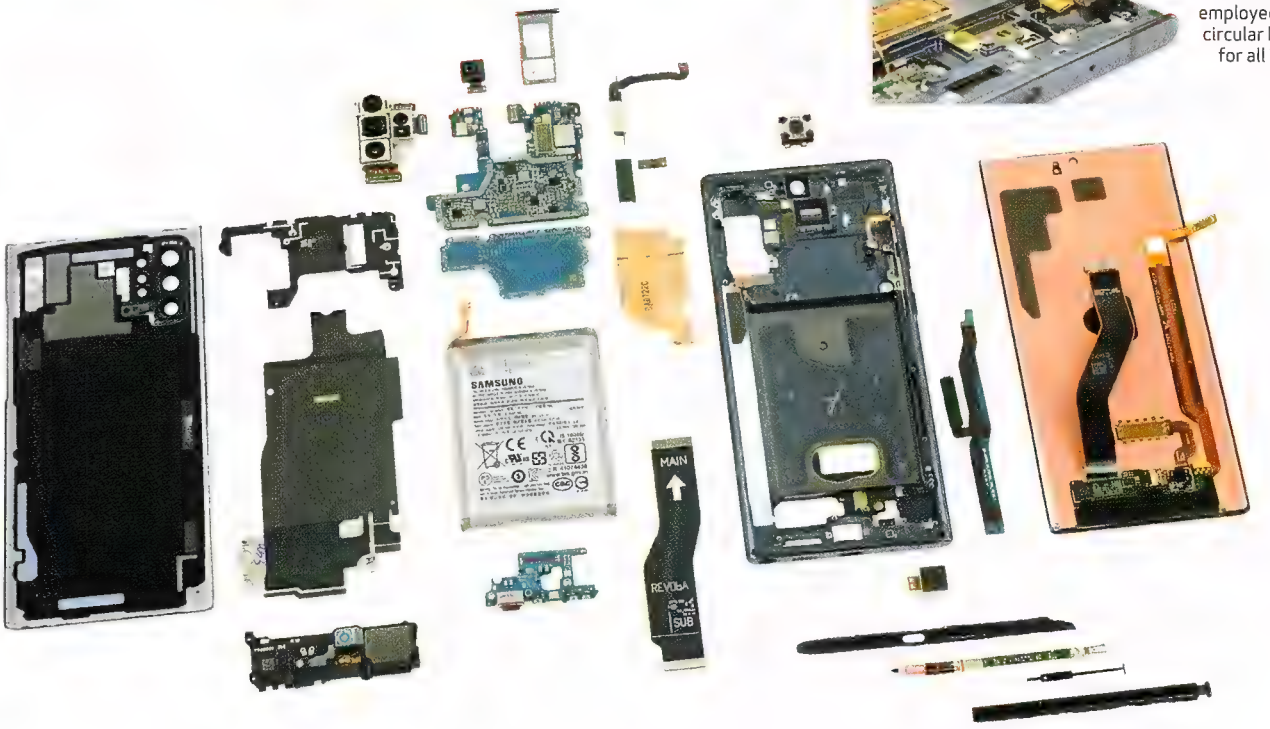
2006

was a good year for *World of Warcraft*, and you can experience it again now *WOW Classic* has launched. The online RPG snared 12 million players at its peak, and hopes to do it again by reverting to patch 1.12. Those who prefer a more up-to-date game can, of course, continue playing version 8.2, which launched in June.

howit'sdone



A square-ish vibration motor! For as long as we can remember, Samsung has employed the same circular LRA motor for all its phones' buzzers.



Samsung Galaxy Note10+ 5G

Where the magic happens.

The new and improved S Pen, now with gesture control, for wizard-like wireless control of your Note10.

Samsung's penned the death of the headphone jack with its newest phablet, the everything-but-the-kitchen-sink Galaxy Note10+ 5G, but what does lie within that monolithic slab?

MAJOR TECH SPECS

- 6.8-inch AMOLED Infinity-O display with 3040×1440 resolution (498 ppi), HDR10+ certified
- Qualcomm Snapdragon 855 paired with 12GB RAM and 256GB internal storage
- 4,300mAh battery
- Four rear-facing cameras (16MP ultra-wide, 12MP wide-angle with OIS, 12MP telephoto with OIS, VGA DepthVision camera), plus a 10MP selfie cam
- Ultrasonic in-screen fingerprint sensor
- S Pen stylus with Bluetooth connectivity and 6-axis sensor
- IP68 dust and water resistance rating

KEY FINDINGS

- As we slice away at the adhesive, we notice that the cover is contoured around the volume and power buttons. A few Phillips screws hold down the midframe assembly – nothing our tried-and-true Mako 64-bit kit can't handle!
- With the midframe removed, we encounter a radical change: the motherboard is solely at the top of the device, Pixel-style. While this allows for a wider battery, it makes the connection between mother and daughterboard trickier, necessitating annoying interconnect cables that block battery access. Our trusty iSclack gives some solid leverage on the battery, but it still takes a lot of isopropyl alcohol before the adhesive surrenders. If we called the Note9's 15.4Wh battery "ludicrous," the Note10+'s 16.56Wh powerhouse must be "plaid." We jettison the SIM tray and release the motherboard, along with the f ive cameras.
- Looks like Samsung stacked its motherboard for maximum space savings, but we quickly separate the boards. The daughterboard comes out without a fuss, bringing the soldered-on USB-C port and lower microphone in tow. Soldered-on isn't our favorite flavor of USB-C port, but at least there isn't much on this board, so replacements shouldn't be too expensive.
- The earpiece speaker looks ordinary, except that it's trapped behind the screen. How do the songs get out? The speaker actually fires into a shallow metal chamber, which channels the sound waves into the tiny grille along the top edge of the frame. After some tedious heating and prying, we get to the back of the Samsung-made 6.8-inch Dynamic AMOLED Infinity-O display, the biggest, brightest, most color-accurate display ever on a Note phone. The ultrasonic fingerprint sensor clings to the back of the display, just as it did to the S10.
- Repairability Score: 3 out of 10 (10 is the easiest to repair). Equally-sized Phillips fasteners means you only need one driver for repairs. Many components are modular and independently replaceable, but no more headphone jack means double duty for the USB-C port. Every repair starts with painstakingly unglueing the fragile glass rear cover. Replacing the glued-down battery is tougher than ever, especially with board interconnect cables to work around. All-too-common display repairs require either a complete teardown or replacing half the phone. ■

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Student Laptops

Whether it's school, college, university or home study, these are the best laptops for learning.

The top contenders for the best student laptops put value over having the top-of-the-line processors and graphics cards. And yet, they still have enough juice to get you through your demanding workload at school – as well as let you partake in some post-school entertainment like light gaming and Netflix.

In fact, some of our picks for the best laptops for students are among the most wallet-friendly devices on the market. But make no mistake: just because they're very affordable, doesn't mean they look cheap. In fact, they also exude style, tout power and offer portability, all without breaking the bank.

01 HUAWEI MATEBOOK 13

$1,599, WWW.HUAWEI.COM

Available for much less than its RRP online, the MateBook 13 comes closer to striking that perfect balance of price and performance than anything else in 2019 so far. It's light and compact, perfect for stowing it in your backpack as you hurry from class to class; and it's fast and affordable as well. Sure, you'll need to keep that charger on hand, as the battery life is underwhelming, but there's still no doubt that the Huawei Matebook 13 deserves its lofty spot on this list.

★★★★★

02 DELL XPS 13

FROM $1,700, WWW.DELL.COM

Dell's flagship laptop has always been rated as one of the best machines for professionals and casual, everyday users. The XPS 13 2019 brings back the entry-level model, making it cheap enough for college students once again. Dell has also fixed our biggest issue with the XPS lineup – the webcam, which has finally been moved back above the display where it belongs. This means that your family and friends won't have to stare up into your nostrils when you're video chatting ever again.

★★★★★

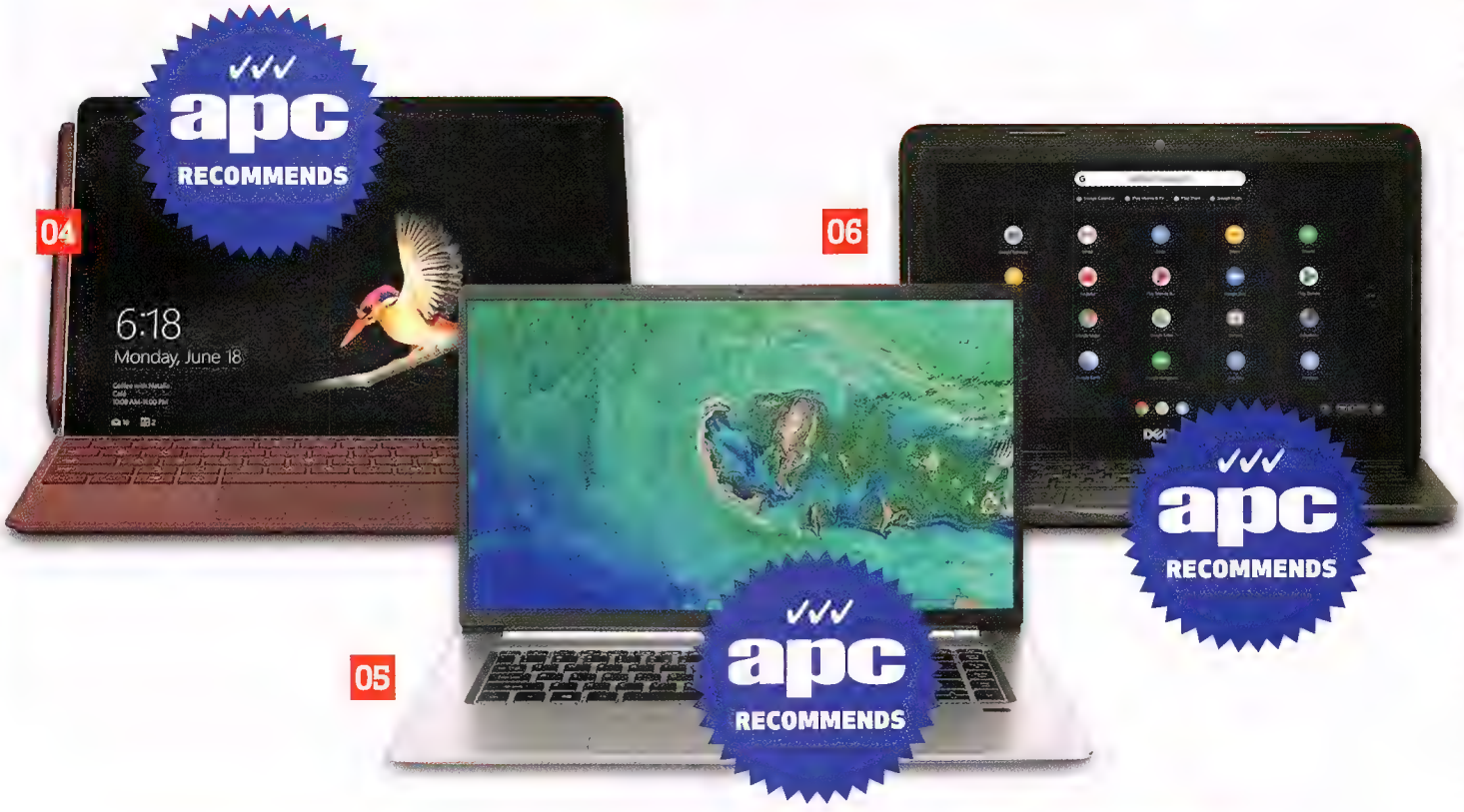
03 SURFACE LAPTOP 2

FROM $1,349, WWW.MICROSOFT.COM

Microsoft's original Surface Laptop was held back by its below average performance, a lack of ports and Windows 10 in S Mode. The Surface Laptop 2 significantly improves on this – with the exception of the ports. It's now packed with 8th-generation Intel Kaby Lake Refresh processors, full-fat Windows 10 Home and a black colour option. It omits USB-C and Thunderbolt 3, but that doesn't change the fact that you will get all your tasks done in style with this laptop with little to no effort.

★★★★½

"Dell's flagship laptop has always been rated as one of the best machines for professionals and casual, everyday users. The XPS 13 2019 brings back the entry-level model, making it cheap enough for college students once again."



04 MICROSOFT SURFACE GO

$499, WWW.MICROSOFT.COM

When you're shopping for a laptop for school that strikes a balance between cost and performance, a bit of style can't hurt. The Microsoft Surface Go isn't just one of the best Windows tablets, but it's also one of the best student laptops, especially from a value perspective. Don't be duped by the low-power components, as Microsoft engineered this tablet to take on all your general schoolwork and more without breaking a sweat. You'll need to add the cost of a keyboard to the price, though.

★★★★☆

05 ACER SWIFT 5

$1,199, WWW.ACER.COM

For school you don't need designer catalogue looks, you need a device that's going to get the job done, and going by that condition, the Acer Swift 5 should be near the top of anyone's list. This affordable ultrabook is packed with the latest 8th-generation Intel processors, not to mention enough RAM and SSD storage, to take on pretty much any homework or project. It's not the most amazing looking laptop in the world, but with that price and spec, looks hardly matter.

★★★★☆

06 DELL INSPIRON CHROMEBOOK 11 2-IN-1

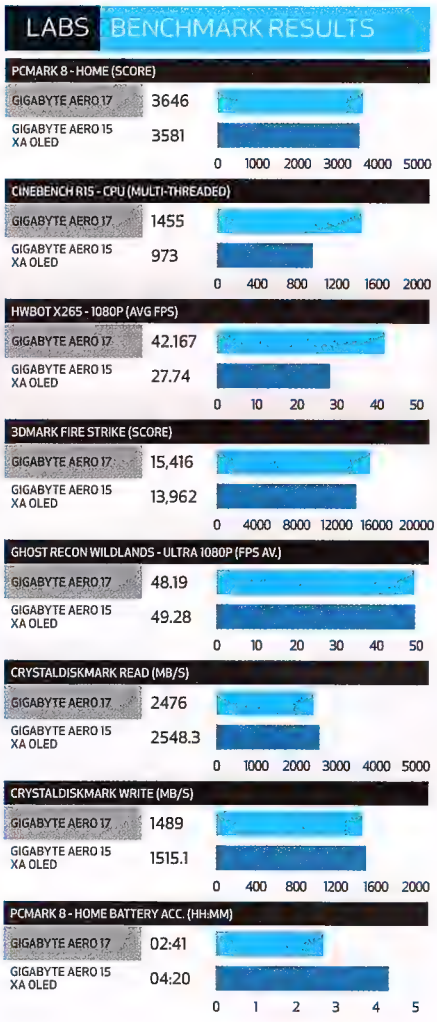
$749, WWW.DELL.COM

Most schoolwork can be done on a Chromebook, which could save you hundreds of pounds. If you want something that will help you do all your research, type up essays, and nothing else, the Dell Inspiron Chromebook 11 2-in-1 might be the perfect fit. Being a Chromebook, it won't be able to handle much heavy lifting, but at this price it doesn't need to, and the convertible form factor makes it pleasant to work with. Great for students on a strict budget.

★★★★☆

LAPTOP

$4,999 | GIGABYTE.COM


LABS BENCHMARK RESULTS
PCMARK 8 - HOME (SCORE)
GIGABYTE AERO 17 3646
GIGABYTE AERO 15 XA OLED 3581
0 1000 2000 3000 4000 5000
CINEBENCH R15 - CPU (MULTI-THREADED)
GIGABYTE AERO 17 1455
GIGABYTE AERO 15 XA OLED 973
0 400 800 1200 1600 2000
HWBOT X265 - 1080P (AVG FPS)
GIGABYTE AERO 17 42.167
GIGABYTE AERO 15 XA OLED 27.74
0 10 20 30 40 50
3DMARK FIRE STRIKE (SCORE)
GIGABYTE AERO 17 15,416
GIGABYTE AERO 15 XA OLED 13,962
0 4000 8000 12000 16000 20000
GHOST RECON WILDLANDS - ULTRA 1080P (FPS AV.)
GIGABYTE AERO 17 48.19
GIGABYTE AERO 15 XA OLED 49.28
0 10 20 30 40 50
CRYSTALDISKMARK READ (MB/S)
GIGABYTE AERO 17 2476
GIGABYTE AERO 15 XA OLED 2548.3
0 1000 2000 3000 4000 5000
CRYSTALDISKMARK WRITE (MB/S)
GIGABYTE AERO 17 1489
GIGABYTE AERO 15 XA OLED 1515.1
0 400 800 1200 1600 2000
PCMARK 8 - HOME BATTERY ACC. (HH:MM)
GIGABYTE AERO 17 02:41
GIGABYTE AERO 15 XA OLED 04:20
0 1 2 3 4 5

Gigabyte Aero 17

Is Gigabyte's bigger ultra-portable pro laptop as airtight as the Aero 15?

There aren't any 4K OLED panels for 17.3-inch laptops this year... so unlike its smaller sibling the Aero 17 has to settle for either a 4K IPS panel from AUO or a 144Hz FHD IPS screen from LG. Considering the 4K display can reproduce 100% Adobe RGB colours and that both the Aero 17's screen offerings come with a Pantone XRite certified colour scheme, it's not exactly much of a sacrifice, even for colour-conscious creatives. The higher-res version even carries a new VESA HDR 400 certification, which means it is capable of reproducing a larger range of colours than regular SDR monitors at a peak brightness of 400 nits.

The range starts with the entry Aero 17 SA which comes with the FHD screen, an Intel Core i7-9750H CPU, 8GB of RAM and a Nvidia GTX 1660Ti GPU, and goes for $2,599. While that might seem reasonable for a 17-incher, the Aero 17 SA only offers half the RAM of similarly priced competitors and the identically specced Aorus 7 SA is readily available for $500 less at $2,099.

At the other end of the spectrum the Aero 17 HDR YA gets the 4K HDR display, a Core i9-9980HK CPU, 32GB of RAM and an RTX 2080 GPU, which will set you back a hefty $6,299. We tested the Aero 17 HDR XA, which is largely the same as the above but with 16GB of RAM and an RTX 2070 GPU for $4,999 (which is still rather pricey for the specs).

Having only 16GB of RAM on a laptop with an overclockable i9 CPU is an unusual configuration that we haven't seen before. This handicap actually puts the Core i9 Aero 17 HDR XA 10 to 15% behind our average of comparable Core i7 gaming laptops in PCMark 8 home and Work benchmarks. It also limits the PCMark 10 performance bump to between two and eight percent against this i7 average. That said, the bigger form factor seems to have allowed Gigabyte to appropriately cool the Core i9 which scores between 43.5% and 26.8% better on multi-core CPU benchmarks than earlier Aero 15 Core i9 variants we have tested. You also see similar 40% performance boosts in CPU heavy tasks like media encoding when compared to anything running a Core i7-9750H.

Even though this thermal throttling has been curbed considerably, you still only get about half the potential performance boost that this chip is capable of. Compared to a much beefier MSI GT76 Titan, which scores between 15 and 36% better on multi-core and media encoding benchmarks, it's clear that Core i9 is still too hot to be worth the cost in a compact gaming or professional laptop like the Aero 17.

The Aero 17 HDR XA performed as expected in gaming benchmarks with the RTX 2070 spitting out more than 48fps averages across all our modern game benchmarks on 1080p Ultra graphical settings. If you want to play in 4K you'll have to drop the graphical settings a little since 4K Ultra nets just 23fps averages on titles like *Ghost Recon: Wildlands*.

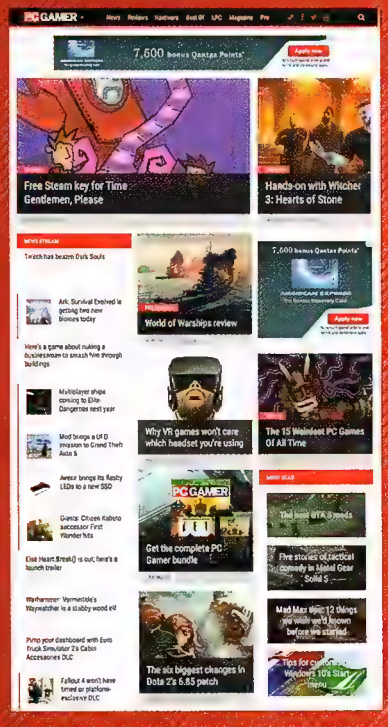
Battery life is better than the former Aero 15 i9 variant, but the Aero 17 HDR XA still only manages two hours and 41 minutes in PCMark 8's Home battery benchmark. While the screen is good, almost everything else about this laptop is pretty standard, making the entire range overpriced – a trend we haven't seen from Gigabyte to date. **Joel Burgess**

Verdict

A powerful HDR workstation that costs a little too much to be good value.

★★★☆☆

SMARTER COOKIES ENABLED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World of Warships review
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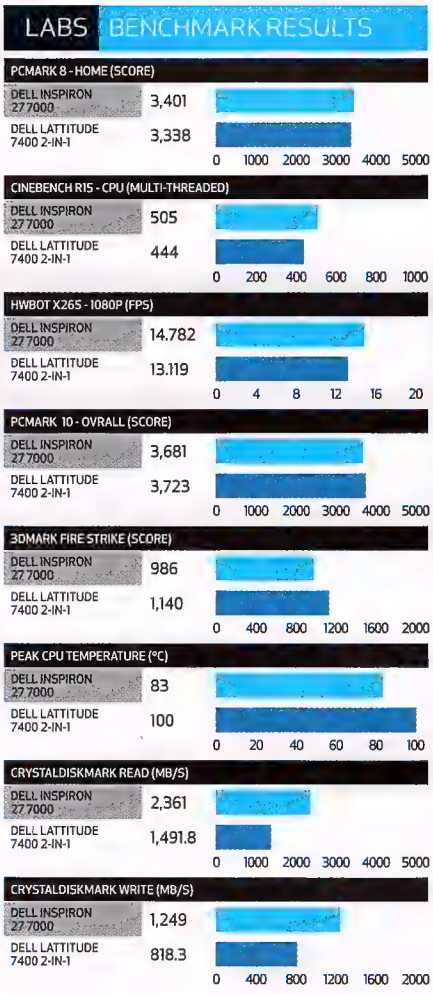
AIO PC

FROM $2,199 | DELL.COM/EN-AU


LABS BENCHMARK RESULTS
PCMARK 8 - HOME (SCORE)
DELL INSPIRON 27 7000 3,401
DELL LATTITUDE 7400 2-IN-1 3,338
0 1000 2000 3000 4000 5000
CINEBENCH R15 - CPU (MULTI-THREADED)
DELL INSPIRON 27 7000 505
DELL LATTITUDE 7400 2-IN-1 444
0 200 400 600 800 1000
HWBOT X265 - 1080P (FPS)
DELL INSPIRON 27 7000 14.782
DELL LATTITUDE 7400 2-IN-1 13.119
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PCMARK 10 - OVRALL (SCORE)
DELL INSPIRON 27 7000 3,681
DELL LATTITUDE 7400 2-IN-1 3,723
0 1000 2000 3000 4000 5000
3DMARK FIRE STRIKE (SCORE)
DELL INSPIRON 27 7000 986
DELL LATTITUDE 7400 2-IN-1 1,140
0 400 800 1200 1600 2000
PEAK CPU TEMPERATURE (°C)
DELL INSPIRON 27 7000 83
DELL LATTITUDE 7400 2-IN-1 100
0 20 40 60 80 100
CRYSTALDISKMARK READ (MB/S)
DELL INSPIRON 27 7000 2,361
DELL LATTITUDE 7400 2-IN-1 1,491.8
0 1000 2000 3000 4000 5000
CRYSTALDISKMARK WRITE (MB/S)
DELL INSPIRON 27 7000 1,249
DELL LATTITUDE 7400 2-IN-1 818.3
0 400 800 1200 1600 2000

Dell Inspiron 27 7000 AIO PC

Dell's AIO gets a new look, but is there anything inspiring beneath the surface?

This year's Inspiron 27 7000 has gone through a rather large metamorphosis, transforming from a stock monitor-looking AIO to a device with a pair of TV-esque legs and a soundbar running along the bottom. This speaker is wrapped in a grey mesh that connects it to some of the more adventurous PC systems we've seen from Dell over the past few years and while we're on the fence on the overall design, the tilting mechanism seems to work well enough to make it practical.

Wrapped in a set of compact bezels is the hero feature – a 27-inch FullHD display that can be configured to include multi-touch compatibility. The glossy display looks vibrant and the white screen surround highlights this bright display even further.

In addition to opting whether or not to set it up as a touch display the Inspiron 27 7000 offers Core i5 or Core i7 CPU variants. These units feature the recently released Intel Core i5-10210U or i7-10510U CPUs which both have faster Turbo boosts than previous processors, but also lose two cores against the previous Inspiron 27 7000s. Systems with the i5-10210U, 8GB of RAM and Intel UHD 620 graphics start at $2,199, or for the higher specced models including a i7-10510U, 16GB of RAM and a Nvidia GeForceMX110 GPU, you'll need to fork out $2,799.

The closest machine we have on record for comparison is a Dell Latitude 7400 2-in-1 with an Intel Core i5-8265U CPU, which was generally only a few percent behind the Inspiron 27 7000 across all our benchmarks. This means that this all-in-one has more than enough power to do general work tasks with ease, but we did notice a little lag on the included security software and the default Internet Explorer browser... so it's not a powerhouse by any means.

When it comes to graphical capabilities the integrated UHD graphics 620 GPU is really the bare minimum, so don't expect the Inspiron 27 7000 to be able to do any graphically intensive tasks. It's even 10-15% behind the Latitude 7400 in all graphical tests, despite supposedly being the same class of integrated GPU. Even on the higher end models with discrete GPUs graphical performance should only be around 50% better than what's offered by the UHD Graphics 620.

The Inspiron 27 7000 comes with a rudimentary wireless keyboard and mouse combo that will get you up and going quickly. While these will suffice for many business users, the stiff keyboard and simple mouse are no-frills solutions that you might want to upgrade, if you can.

Ports for this unit are on the lower rear of the device and include everything you'd need with a few USB 3.1 Type-A slots, a USB 3.1 Type-C, an ethernet port, an SD card reader 3.0, 3.5mm mic/headphone jack and an HDMI 1.4 out.

There are some alternative AIO units with AMD Ryzen 5 CPUs that you can get pretty easily for $500 less and the former Core i7 Inspiron 27 7000s are more powerful and cheaper, so this unit simply isn't the best value. **Joel Burgess**

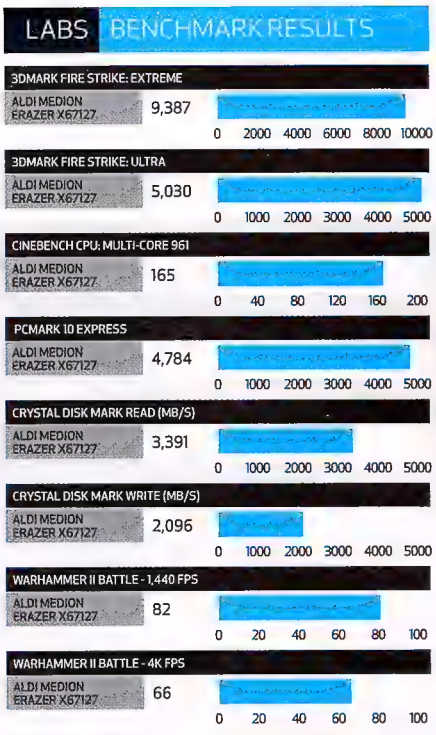
Verdict

A lightweight home or office AIO that looks nice, but isn't the best value.

"The whole system purrs very quietly when idling and, frankly, feels like one of the best, most solidly-built PCs we've seen from any of Australia's systems integrators."
apc
RECOMMENDS

DESKTOP PC

$1,999 | MEDION.COM/AU


LABS BENCHMARK RESULTS
3DMARK FIRE STRIKE: EXTREME
ALDI MEDION ERAZER X67127 9,387
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3DMARK FIRE STRIKE: ULTRA
ALDI MEDION ERAZER X67127 5,030
0 1000 2000 3000 4000 5000
CINEBENCH CPU: MULTI-CORE 961
ALDI MEDION ERAZER X67127 165
0 40 80 120 160 200
PCMARK 10 EXPRESS
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0 1000 2000 3000 4000 5000
CRYSTAL DISK MARK READ (MB/S)
ALDI MEDION ERAZER X67127 3,391
0 1000 2000 3000 4000 5000
CRYSTAL DISK MARK WRITE (MB/S)
ALDI MEDION ERAZER X67127 2,096
0 1000 2000 3000 4000 5000
WARHAMMER II BATTLE - 1,440 FPS
ALDI MEDION ERAZER X67127 82
0 20 40 60 80 100
WARHAMMER II BATTLE - 4K FPS
ALDI MEDION ERAZER X67127 66
0 20 40 60 80 100

Aldi Medion Erazer X67127

A well built gaming PC that's small and quiet – and great value.

I still talk about the day I bought my son his very own full-sized jumping castle for $200 from Aldi. Ever since I've been looking for a better bargain to beat it. Can the famously-cheap store do so with this gaming PC?

Medion is a German computer brand and Aldi is the exclusive distributor in Australia. The Erazer X67127 is based around a modified InWin 301 mini-ATX Tower which sports illuminated RGB detailing at the front, an LED exhaust fan at the rear and two, easily-removable matte-black side panels (one of which has hexagonally-detailed vents) that match the rest of the chassis. In the box is an optional Perspex panel which we recommend using as it allows you to peer into the impressively-cable-managed interior with its three RGB case fans and illuminated heatsink-fan. The whole system purrs very quietly when idling and, frankly, feels like one of the best, most solidly-built PCs we've seen from any of Australia's systems integrators.

The specs are impressive too. The CPU is Intel's 9th-Generation Coffee Lake i5-9400 which has six cores and a stock speed of 2.9GHz but which can ramp-up to 4.1GHz. There are two 8GB sticks of Samsung DDR4-2666 RAM, a 512GB PCIe SSD by Phison and a 1TB mechanical hard disk. Everything is plugged into an MSI Mortar motherboard and graphics come courtesy of Nvidia's powerful RTX 2070 card. There's not much room for upgrades (just two spare RAM slots and a PCI-Express x16 slot) but, as off-the-shelf PCs go, this has got pretty much everything you need to handle 4K games and VR.

The front of the case offers two USB 2 ports plus two headphone jacks while the rear sports two USB 3 ports (one Type-A and one Type-C), two additional USB 2 ports, a PS/2 peripheral port, Gigabit Ethernet, five audio jacks and an optical port. There's onboard graphics but you'll want to use the Nvidia's connectors. The system comes with a functional, unbranded optical mouse. A keyboard is not included.

The i5 CPU and its six cores (and six threads) scored 961 in the Cinebench R20 benchmark which rivals a two-generation-old hyperthreaded Core i7. Scores of 4,163 in PCMark 8 and 4,784 in PCMark 10 Express are, Futuremark tells us, both spot-on for a typical 4K gaming machine. 9,387 3DMarks in Firestrike Extreme and 5,030 in Firestrike Ultra are good but slightly low considering the powerful Nvidia RTX 2070 – suggesting there's some bottlenecking from the processor.

Meanwhile, in the ageing *Warhammer II* Battle test it averaged 66fps at 2,560 x 1,440 resolution. However, when we tried the punishing *Metro Exodus* Extreme benchmark it averaged just 26fps (34fps at 1080p) – you'll need to drop the settings to keep things smooth.

It's worth noting that the fans ramp up and become audible when under a gaming load, but it never becomes more than an audible swoosh.

Ultimately, it's no $200 jumping castle but it's small, quiet, well-built, costs slightly-less than the sum of its parts, has a two-year RTB warranty and represents very good value at $1,999. ■ **Nick Ross**

Verdict

Fast, great value and high quality, but it's more sensible than a must-buy Aldi bargain.

$1,299 (WI-FI MODEL), $1,499; (4G MODEL) | WWW.SAMSUNG.COM

Samsung Galaxy Tab S6

The best Android tablet currently on the market.

Following on from this year's mid-range Galaxy Tab S5e, Samsung's latest Android tablet is clearly gunning for the iPad Pro crowd with its new (and very premium) Galaxy Tab S6, a productivity-focused device that just might score itself a few converts.

For those who want to get some serious work done, the Tab S6's built-in Samsung DeX mode provides the tablet with an optional desktop-style interface, complete with folders, overlapping windows and all the usual PC conveniences. Naturally, you can improve your productivity by pairing a Bluetooth keyboard and mouse to the device, or simply purchase the Tab S6's official keyboard cover ($199), which has its own touchpad for precise pointer control.

Like Apple's top-tier tablet, the Galaxy Tab S6 can be used in tandem with a specially-designed stylus, in this instance, an upgraded version of Samsung's own S Pen. However, unlike the optional (and incredibly expensive at $198)) Apple Pencil, Samsung's S Pen is included in the box at no extra cost, offering similar functionality and touchscreen latency.

While Apple's drawing software is perhaps more refined in its execution, Samsung makes up for this by including a number of clever stylus-based features, such as Smart Select, which lets you draw a box around a section of your screen and the contents within transcribed into text. Another neat inclusion in this year's model is the ability to use Air Actions, which allow you to perform gestural commands by waving the S Pen in front of the Tab S6's display. Sure, they're completely unnecessary, but we can see the appeal in flicking the stylus to skip through tracks on Spotify, for instance.

Whether you want the S Pen or not, Samsung clearly sees it as integral to the device, which itself feels a bit like a tablet-sized Galaxy Note 10. For one, the Tab S6 has a permanent indentation on its rear where the S Pen is magnetically attached, allowing the Bluetooth-enabled stylus to wirelessly charge when not in use – and good luck finding an official case without a large bump to house it in.

Despite being nearly identical to the aforementioned Tab S5e in terms of design and dimensions, the Tab S6 is a great deal more powerful than its mid-range sibling, offering the same Snapdragon 855 chipset that powers Samsung's 2019 flagship smartphones in the US.

This makes the Tab S6 ideal for gaming, while also ensuring that your work is never hampered by slowdown or sluggish navigation. The Tab S6 will also last a full day of intense use (with some juice left to spare) thanks to its hefty 7,040mAh battery, and we're happy to note that fast-charging is supported.

From an audio-visual standpoint, the Tab S6 is truly extraordinary. A gorgeous 10.5-inch Super AMOLED display offers terrific colour vibrancy and contrast, and the inclusion of four AKG-powered speakers with Dolby Atmos support brings strong and immersive audio that's able to fill a room and entertain a small group. ■

Stephen Lambrechts

Verdict

With the Galaxy Tab S6, Samsung has finally delivered a viable iPad Pro alternative for Android fans.

★★★★☆

apc RECOMMENDS

FITNESS TRACKER

$379.95 | WWW.FITBIT.COM

Fitbit Versa 2

The near-perfect fitness tracker with some smartwatch perks.

When it comes to the design, Fibit's mantra seems to be one of 'if it ain't broke, don't fix it'. The 'squircle' design of the Apple Watch and the original Versa seems to have been embraced by users and Fitbit has carried that on to the Versa 2. At first glance, the new fitness watch does look strikingly similar to its predecessor, but closer inspection reveals a few small tweaks giving the Versa 2 a very stylish look indeed.

With a depth of 0.47 inches (12mm), it's only a tiny bit thicker than the Apple Watch 3, but since the chassis tapers inward toward the heart monitor underneath, it actually looks slimmer. And, with a screen size of 40mm, it should fit most wrists.

Thankfully Fitbit has removed its branding from the bottom bezel of the Versa, meaning the bezels on the Versa 2 are slightly thinner, giving you a tad more screen real estate than before. While the display's black background is usually quite successful at disguising the bezels, they are quite obvious at some angles, albeit easy to ignore.

Where the original Versa had three buttons on the chassis – two on the left and one on the right – the Versa 2 sports just a single button on the left and serves as both the 'select' and the 'back' button. This means you're never more than a press or two away from the feature you need to access, while any other navigation you need to perform is done via the touchscreen.

Visual satisfaction aside, the Versa 2 is a faster watch than its predecessor, thanks to a new processor under the hood. That's not to say the original Versa suffered from any lag or performance issues, but if you've used it before and upgraded to the Versa 2, you will notice a marked difference in operational smoothness. Navigating between pages, launching and closing apps, and bringing up new health data in the Today pane (accessed by swiping upward on the screen) is quicker than before.

Like all other Fitbit devices, the Versa 2 has a pretty decent battery life. Fitbit claims you can get five days with standard use. We managed to push it to just over six days but that was perhaps because we had the screen brightness dimmed to the lowest setting.

The addition of Amazon's voice assistant to the Versa 2 means the wearable should be able to do a lot more than its predecessor. To use the voice assistant on your new watch, though, you will first have to download the dedicated Alexa app to your phone and link your Amazon account within the Fitbit app. Despite all that, there are still limits to what Alexa can do for you.

If you've never used the original Versa and are in the market for a new reasonably priced smartwatch, then the Versa 2 is a compelling proposition. Physical tweaks to the design and a fabulous display make the Versa 2 look like a premium wearable that would look good on almost anyone, while the addition of Alexa offers something different to the Fitbit range, even though it's not perfectly implemented. ■

Sharmishta Sarkar

Verdict

Incremental improvements to the series make for a good value and very useful smart watch.

MOTHERBOARD

$629 | WWW.GIGABYTE.COM

Gigabyte X570 Aorus Master

Power over presentation.

The X570 Aorus Master isn't much to look at. Gigabyte has never been known for overly flashy motherboards, but the Aorus Master feels like it's reached a new level of function over form. With an almost brutalist black and gray design and barely any lighting – just a few LEDs around the rear I/O – this isn't a mobo for those trying to make their build look as bright and colorful as possible. Those LEDs are addressable, yes, but they're distinctly underwhelming in action.

Thankfully, appearance isn't an indicator of quality. The Aorus Master might look dull, but it functions well. Looking at the raw numbers, it pretty comfortably outperforms previous-generation X470 motherboards when equipped with a new 3000-series Ryzen CPU. The performance differences are small but notable, with the exception of SSD transfer speeds. With the staple PCIe 4.0 support that the X570 generation introduced, the Aorus Master has blisteringly fast M.2 transfer speeds, breaking 5,000MB/s in our tests. It's still immensely satisfying to see, even if it's a niche feature that has the potential to be bottlenecked by other parts of any given system.

Memory latency and processor-heavy tasks come out more or less the same as previous-generation boards, albeit with the Master coming out just ahead. The board doesn't allow for much overclocking potential, but that's more of a problem with the new Ryzen processors that has yet to be resolved by AMD. Even so, it's not hard to get our Ryzen 9 3900X running at a stable 4.2GHz, though sadly the Master needs the same voltage to achieve that as the X470 board we tested.

The performance comes at a cost, however. The Aorus Master guzzles power under load, demanding far more than the X470 board – disappointing when examined alongside the modest performance gains. Idle wattage isn't much higher, but if you like to overclock or have your system running demanding software for hours on end, this might not be the right motherboard for you. The reason for this increased power draw isn't clear; the dedicated fan and numerous temperature sensors could be the cause, although other X570 boards we've seen haven't had this problem.

In terms of physical design elements, rather than benchmarking performance, the Master starts to look a bit more appealing. It comes with three of those super-speedy NVMe Gen4 ports for M.2 SSDs, each with its own removable heat spreader.

In terms of connectivity, this board has all the usual trimmings. Wi-Fi support on the rear I/O was a welcome surprise (Gigabyte tends to stick "Wi-Fi" in the name of boards with their own antenna ports), and there's support for USB-C ports from the front I/O, joined by a USB-C port on the rear I/O. This rear port supports fast-charge for mobile devices, too; a minor addition for some, but a lifesaver for others. The board also has the increasingly common two-digit calculator-style display, handing you a hopefully-helpful error code in the event of a failure to boot. The tiny motherboard fan and clever thermal design do good work as well.

There's nothing important you'd miss if you threw this board into a generic system build. It's not exciting, but it is pretty good. Unless you're planning on upgrading your CPU and storage, it's an unnecessary replacement for an X470 or even X370 board, but if you're looking to build an entirely new system, you could definitely do worse than the Aorus Master. ■ **Christian Guyton**

Verdict

Very fast M.2 transfer speeds; generally solid performance; good thermal design.

apc RECOMMENDS

Critical specs:

Socket 1151 (8th & 9th-gen Intel CPUs), DDR$ 4266MHz, DP, HDMI, 6 x SATA, 2 x PCIe Gen3 x4 M.2, 2 x USB 3.2 Gen2, 6 x USB 3,2 Gen1, Polychrome RGB Sync, 7.1 channel audio.

MOTHERBOARD

$259 | WWW.ASROCK.COM

Asrock Z390 Steel Legend

All the essential features and then some, in a great looking and value-oriented package.

The Z390 Steel Legend focuses on cooling and usability and has a unique cut out area around four of the SATA ports. The board includes a large aluminium alloy heatsink, dual full-coverage M.2 SSD heat sinks, and 60-amp power chokes that are usually found on boards a bit higher up the product stack. Asrock's says its Steel Legend design philosophy is centred around durability and its own unique design aesthetic that appeals to the mainstream enthusiast market.

The board design itself is unique because of that cutout around four (of six) SATA ports which should allow for easier access when in a case. Often, but depending on the chassis, it can be difficult to access the cables and route them, but this design allows the cables to drop right into the grommets and get out of sight. Outside of that, the PCB is black with white and grey camouflage styling accents on most of the board.

> "The board design itself is unique because of that cutout around four (of six) SATA ports which should allow for easier access when in a case."

The heat sinks are silver and create a nice contrast to the mostly-black aesthetic.

RGB LEDs are found on that same side of the board running nearly the full length, while the RGB also illuminates the Steel Legend nomenclature LED strip. The large chipset heatsink also has RGB lighting. The board also includes both a 3-pin addressable RGB header and a traditional 4-pin RGB LED header. You can control all onboard and connected RGB LEDs with Asrock's Polychrome RGB Sync software.

Hardware-wise, the board's unique feature is USB 3.2 support; however, it still runs at 10 Gbps speeds. The USB 3.2 Gen2 Type-C port also delivers three amps of power to the port (versus 1.5A for 3.2 Gen1). The true USB 3.2 Gen2 20 Gbps devices will be USB 3.2 Gen 2x2 convention. So, it says 3.2, but is still a 10 Gbps maximum port. The Z390 Steel Legend includes the full complement of features we expect from a mid-range Z390 board. A total of six SATA3 6 Gbps ports, dual M.2 slots each with heatsinks (both support SATA and PCIe drives), 128 GB DRAM capacity with speeds up to 4266+ MHz, and two full-length PCIe slots (supports Crossfire) with one slot using steel armor. The eight-phase Digi Power design uses 60A chokes and Nichicon 12K black caps that should handle the i9-9900K without worry.

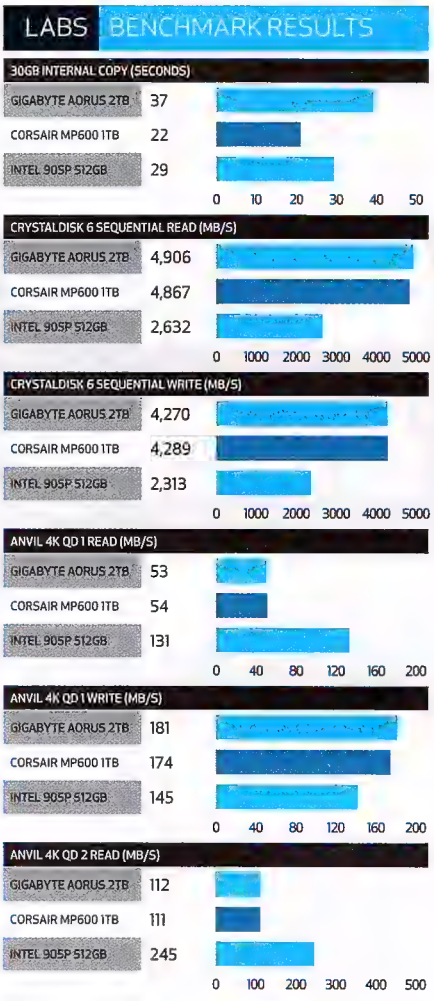
On the audio side of things, the board uses a Realtek ALC1200 codec with Nichicon Fine Gold Series audio caps and has PCB isolation from the rest of the board as well as individual PCB layers for left and right channels. Lastly, the Intel I219-V Gigabit controller handles LAN duties. Wi-Fi is not included. However, there is an M.2 Key E slot for a Wi-Fi module.

Overall the board has a lot of features and should make for a good option in the mainstream enthusiast segment. ■ **Joe Shields**

Verdict

Great set of features at a good price, good looking without ridiculous amounts of RGB.

★★★★½


LABS BENCHMARK RESULTS
30GB INTERNAL COPY (SECONDS)
GIGABYTE AORUS 2TB 37
CORSAIR MP600 1TB 22
INTEL 905P 512GB 29
0 10 20 30 40 50
CRYSTALDISK 6 SEQUENTIAL READ (MB/S)
GIGABYTE AORUS 2TB 4,906
CORSAIR MP600 1TB 4,867
INTEL 905P 512GB 2,632
0 1000 2000 3000 4000 5000
CRYSTALDISK 6 SEQUENTIAL WRITE (MB/S)
GIGABYTE AORUS 2TB 4,270
CORSAIR MP600 1TB 4,289
INTEL 905P 512GB 2,313
0 1000 2000 3000 4000 5000
ANVIL 4K QD 1 READ (MB/S)
GIGABYTE AORUS 2TB 53
CORSAIR MP600 1TB 54
INTEL 905P 512GB 131
0 40 80 120 160 200
ANVIL 4K QD 1 WRITE (MB/S)
GIGABYTE AORUS 2TB 181
CORSAIR MP600 1TB 174
INTEL 905P 512GB 145
0 40 80 120 160 200
ANVIL 4K QD 2 READ (MB/S)
GIGABYTE AORUS 2TB 112
CORSAIR MP600 1TB 111
INTEL 905P 512GB 245
0 100 200 300 400 500

SSD

$719 | WWW.AORUS.COM

Gigabyte Aorus Gen4 2TB

This PCIe 4.0 SSD is seriously hot stuff.

With the arrival of the new Gigabyte Aorus Gen4 SSD, we're beginning to wonder whether solid-state storage should include active cooling. The Aorus is notable for its double-sided copper heat spreader, which lowers temperatures by 16 percent. The question is whether this improves performance. After all, do SSDs actually run that hot?

We have answers for you, but first let's cover off the Aorus's speeds and feeds. It's the second SSD we've seen with support for the latest 4.0 specification of the PCI Express interface, the first being the Corsair MP600. It probably shouldn't come as a surprise that both drives feature the Phison PS5016-E16 controller chipset, given it's one of the first to support PCIe 4.0.

For the record, the Phison PS5016-E16 features eight NAND channels, DDR4 DRAM caching, four PCIe 4.0 links, and the NVMe protocol in 1.3 spec, so it's bang up to date. Paired with TLC NAND flash memory and 2GB of cache memory, the upshot, for this 2TB model of the Aorus range at least, includes sequential read performance of 5GB/s, writes of 4.4GB/s, and IOPS around the 750,000 mark.

These are, we need hardly point out, very big numbers indeed, even if they do leave a fair bit on the table in terms of the peak theoretical bandwidth available from a quad-link PCIe 4.0 interface. The question is how all that translates into real-world performance. The answer involves the aforementioned thermal properties we alluded to at the outset.

Throw a large sustained workload at the Auros and it starts out crazy fast, but eventually slows to what you might characterise as SATA speeds. In our testing, it took around 300GB of sustained writes before the drive dropped from performance measured in GB/s down to around 400–600MB/s. At which point it was very, very hot to the touch.

Long story short, we believe the Auros thermal throttles under such workloads, even with the copper heat spreader. The same is true of the Corsair offering, but that was a significantly smaller drive. Point being, if it takes nearly half the drive's capacity to throttle, that's easier to tolerate. Indeed, a 250GB drive based on this technology would probably fill up before it throttled. With 2TB on offer here, you're arguably more likely to actually run up against this limitation.

Anyway, elsewhere, the Auros largely performs extremely well, its numbers very much in line with the Corsair MP600, except for our internal file copy test, which was disappointing for reasons we do not fully comprehend. In any case, it still qualifies as a very, very fast NAND drive. Intel's Optane drives maintain the crown in terms of 4K random access performance, of course, but these new PCIe 4.0 NAND drives aren't too shabby for 4K, either.

If this drive is anything to go by, active cooling may be necessary to sustainably make the most of the huge bandwidth on offer from PCI Express 4.0. If this Auros is overheating at 5GB/s, hitting 8GB/s could send solid-state drives into serious meltdown. ■ **Jeremy Laird**

Verdict

Huge peak performance; very strong feature set. Performance eventually throttles.

★★★★½

MONITOR

$TBA | WWW.ASUS.COM

Asus ProArt PA34V

Asus throws a curveball at content creators.

Everything from 4K resolutions and high refresh rates to true HDR visuals, massive panel sizes, and more are on the menu, in this product space. At first glance, therefore, Asus's ProArt PA34V looks pretty pedestrian. With a 34-inch curved panel, a mere 3440x1440 pixels, and 100Hz refresh, it's hardly poverty stricken when it comes to features.

It all comes down to remit. The ProArt is pitched at professional content creators. What's more, while a 34-inch curved 1440p 100Hz gaming panel isn't novel, it's unusual in the pro space. Asus hasn't spared the pennies from a design and engineering perspective either. The stand is beautifully machined and the screen enclosure feels expensive. It's all a clear cut above the usual consumer electronics fare.

The positive vibes continue when you fire the ProArt up. Seasoned eyes will recognise what is a very nicely calibrated IPS panel. Indeed, Asus provides a calibration report with each PA34V. Our review sample's report shows Delta Es below two across the board, with all but one entry below one. Very nice.

While we're discussing technicalities, professionals will appreciate that the ProArt is good for 100 percent of the sRGB color space and also HDR-10. But that doesn't mean it's a true HDR display, due to its lack of local dimming and a maximum brightness of 300cd/m2. However, what the HDR-10 compliance does ensure is 10-bit color depth and support for the Rec.2020 color space, which will be a target for some content creators. Among other relevant presets in the comprehensive OSD is the commonly used HDTV Rec.709 preset. Anyway, in our testing the ProArt is mostly a star performer, whether that's the smoothness of rendered gradients, its impeccable viewing angles, or the huge detail on offer in test white scales.

What the ProArt is not, is perfect. In calibration terms, a little compression is visible in black scales. That could be dialed out. More of a permanent problem is the relatively coarse pixel pitch and desktop space. In the market you can choose from a wide range of 4K UHD monitors. Admittedly, you're not going to get a high-end pro 4K monitor for a bargain price, but a prosumer 4K panel is well within reach, and that secures you much more screen real estate and sharper imagery.

What we'd really like to see is something akin to the LG 34WK95U. That's also 34 inches and curved, but delivers a 5K2K pixel grid, enabling you to view full resolution 4K content with space left for menus, toolbars, and timelines. Of course, the 34WK95U is very expensive at around $1,850, but if you could stretch to the LG, it's worth the extra cash in return for dramatically improved visual ergonomics.

The PA34V is a slightly hard sell. The 100Hz refresh and adaptive sync support are nice for a bit of gaming on the side, but that's hardly a key priority for content creators. The USB Type-C input support is again welcome, especially for anyone who uses a laptop, but it's surely a given in 2019. Overall, the Asus ProArt PA34V is a very nice panel and as an all-arounder, it's seriously appealing. ■ **Jeremy Laird**

Verdict

Lovely IPS panel; nicely calibrated; fabulous build quality.

★★★★½

"The mobile app is easy to use, and the browser version should be instantly familiar to anyone who's used cloud-based storage before."

NAS

$599 | WWW.WESTERNDIGITAL.COM

WD MyCloud Home Duo 8TB

Backing up beautifully.

NAS boxes are nothing new to us, and if you're a seasoned system builder, there's a reasonable chance you've assembled one yourself at some point. Of course, what we're describing here is a home-made NAS box. If you prefer the easy life, there are plenty of pre-built NAS systems out there, many of which are simpler and easier to use than a custom-made machine. Western Digital's MyCloud Home is one such example, aimed at families and working professionals who want a straightforward data storage solution. It couldn't be easier to use, either – just plug in the power and ethernet cables, and this little white and silver cuboid is ready to go.

Accessing the drive (or drives, in this case; our Home Duo comes with two 4TB hard drives concealed inside) is a quick and convenient process, too. On a computer, it's as simple as accessing the MyCloud website via your browser of choice, which then functions not dissimilarly to Dropbox or Google Drive – just drag and drop your files there, and they're automatically saved. Alternatively, you can set up the desktop app's sync mode, which backs up all the files on a home or work computer automatically. For mobile devices, WD provides an Android/iOS app from where backups (and the MyCloud's on-drive storage) can be managed.

The mobile app is easy to use, and the browser version should be instantly familiar to anyone who's used cloud-based storage before. So, the attached software is solid; on to the hardware. The MyCloud Duo 8TB has, as the name suggests, two separate 4TB drives. In its default state, though, there is actually only 4TB of usable storage space (3.51TB after the preloaded software, if you want to be nitpicky). This is because the two drives are set to Mirror Mode using RAID 1, which produces a duplicate of your files on the mirrored drive. While this is a pretty solid fail-safe feature, it does effectively halve the amount of available storage space. Fortunately, you can choose to configure the drives using JBOD for the full 8TB.

With a standard Gigabit ethernet connector, your internet speed is theoretically the boundary to transfer speeds before the older HDD connector format gets in the way. However, in our internal tests, we saw speeds of around 40MB/s across a local connection; an unimpressive figure, to say the least. Transfer speed isn't really a concern if you're looking to use this as a wireless backup for your data, to be fair; the desktop sync function runs in the background, and because file duplication happens in the box rather than on your system, Mirror Mode has no impact on your day-to-day PC use.

The key downside when compared to a home-brew NAS machine is the lack of true customisability. The Home Duo functions more like an external hard drive with some nifty wireless access functions, thanks to the MyCloud app, rather than the superior functionality of proper NAS systems. There's no processor, no RAM, no OS. While the desktop app does allow for standard access through the Windows File Explorer, the whole process sits within the confines of WD's own access software. That's not inherently a problem, but it could be frustrating for seasoned tech heads who want to tweak their hardware more. If you're just looking for a simple but effective storage solution, though, this isn't bad. ■ **Christian Guyton**

Verdict

App functions well; potential for upgrades; easy setup.

CASE

$180 | WWW.NZXT.COM

Nzxt H510i

A refreshingly simple yet intelligently engineered mid-tower case.

Nzxt has carved out a bit of a niche for itself with its range of thoughtfully engineered cases that focus on refinement and the user experience rather than all out 'look-at-me' bling. The H510i matte black case we have for review is one of the more refreshingly subtle cases we've seen in recent times, and that alone is a good thing.

A visual inspection of the H510i immediately shows it to be a well thought out and engineered case. It comes with one of the most impressive cable management systems we've ever seen. All of the front panel and power cables can be discreetly routed away behind the motherboard tray or behind a vertical insert. There's complete watercooling support, though the H510i can only accept 240mm or 280mm radiators. If you need room for a triple rad, you'd need to move up to the H710i. Additionally, you can mount a GPU vertically with an optional PCIe riser card.

A pair of addressable RGB strips are alsio included. While this is perhaps almost contrary to the rest of the case's subtle looks, when combined with the tempered glass side panel, it really allows you to show off a beautiful system. The PSU section is covered, and the end result is a very clean looking build with the absolute minimum of cables visible.

Assembling the system was simple with the cable management implementation really adding to the ease of the build. We used a very large MSI RTX 2080 Gaming which just fit length-wise with a front mounted 240mm radiator. This proves that the 510i is about as small as it's possible to make an ATX case that can accept a complete water-cooled, high-end ATX system and full-sized GPU without compromise.

Nzxt includes a hardware fan and RGB controller with its 'i' series of cases. It can be controlled by the CAM software suite. While some users might baulk at the need to run yet another software package, the CAM software has a rather intuitive design and didn't have anything really worth criticising during our testing. It can control two RGB lighting strips and up to three fans, supporting both voltage regulated and PWM fans. It comes with a full set of monitoring and even overclocking functionality. It's clear the CAM software is designed to complement Nzxt's unique motherboards as well.

It might be fairly compact for a mid-tower, but due to the use of steel and tempered glass, the H510i weighs in at a rather chunky 6.8Kg. The fully loaded system is surprisingly hefty indeed.

The 510i comes with a top mounted USB 3.0 port as well as a Type-C 3.1 port. While it's nice to see a bit of forward thinking with the inclusion of Type-C, an extra pair of standard Type-A ports would be welcome for convenience.

At $180 the 510i isn't the cheapest case you'll come across, but for a user looking for something that doesn't look like it belongs in a *Transformers* movie, then the H510i is definitely worth considering. It's sleek, subtle and refined and we recommend it. ■ **Chris Szewczyk**

Verdict

A great blend of subtlety and engineering with just the right amount of tempered glass and RGB.

★★★★☆

MOUSE

$149 | WWW.LOGITECH.COM/AU

Logitech MX Master 3

Reinventing the wheel, successfully.

Targeting advanced users, like creators, software developers, engineers, analysts and other professionals, the MX Master 3's innovative electromagnetic scroll wheel and per-app customisable settings mean you can fine-tune this mouse to be an ideal companion for any software you use. Additionally, you can control and send info across up to three PCs (Windows, MacOS and/or Linux), so the mouse can be with you for every step of multi-device activities.

The scroll wheel has been updated with electromagnetic technology – dubbed MagSpeed – that lets you toggle between smooth ('Freespin') and precise ('Ratchet') scrolling modes. It's the only part of the mouse made in Switzerland (the rest in China). While the older MX Master mice's wheels can also scroll in small, line-by-line increments or spin freely, they make some noise when doing so. Even when scrolling line by line, with each line creating a click of friction you can feel, the MX Master 3 is silent. On top of that, when in free spin, the wheel spins for much longer and more smoothly than the mice's predecessors or perhaps any other mice I've ever used.

You can toggle between Ratchet or Freespin mode by hitting the button underneath the scroll wheel or use SmartShift (activated in the software), which adjusts the mode based on how you move the wheel. SmartShift is very helpful when scrolling through long documents, PDFs or spreadsheets. Freespin rapidly took me past many pages until I reached the section I wanted, and when I placed my finger back on the wheel, I could make more precise scrolls to home in on the paragraph I wanted.

The mouse is pretty chunky, especially height-wise, but that height gives the palm a firm, yet softly textured, place to rest. Whether using a palm grip or claw grip, my pointer's bottom knuckle was particularly comfortable on the mouse's raised hump. The thumb rest is texturised and the palm rest and where you keep your pinky have the same feel for long-lasting comfort. The right and left-click buttons are slightly smoother. It's not the softest mouse in town, but it's definitely an upgrade from a flat, plastic chassis.

The wireless mouse uses a USB Type-A receiver and connects to a PC via 2.4 GHz up to 33 feet (10 meters). If you use other Logitech products using the Logitech Unifying Receiver, you can use just one receiver for up to six products, which is very helpful if you're low on ports. You can also connect it without the receiver via Bluetooth Low Energy, particularly useful if you're pairing with a device that has no USB Type-A ports at all. The new MX Master 3 has the same sensors as the MX Master 2S, Logitech's Darkfield sensor with a max CPI (counts per inch, sometimes called DPI) of 4,000, which is high for a productivity mouse They say you shouldn't reinvent the wheel, but when you can make it smoother, quicker, quieter, more responsive and just plain more fun to use, why not? Logitech managed that with the MX Master 3, while also enhancing its ease-of-use with a highly customisable button layout that's almost completely navigable without taking your hand off the mouse. ■

Scharon Harding

Verdict

Large and very comfortable, its star feature is the high-tech scroll wheel which is a joy to use.

★★★★½

apc RECOMMENDS

MOUSE

$129 | WWW.ASUS.COM

Asus ROG Strix Carry

Boy, you've gotta carry that mouse, carry that mouse a long time.

We love a beautiful desk, where function is the strongest attribute any peripheral can have.

Which brings us to the Asus ROG Strix Carry, a gaming peripheral that indeed bucks the trend. There are no lights. There's really nothing in the way of glitz, outwardly, and indeed no room for it, because Asus has carved away just about all it can in pursuit of creating a portable wireless gaming mouse. And we like that: This doesn't look out of place on any desk, it's (technically) pocketable, if you don't mind a mouse-shaped bulge in your pants (or you could use the included pouch, like a sensible person), yet Asus has kept itself calm enough to avoid cutting the size down beyond the point of usability. Sure, if you've been mousing wrong for so long that your right hand has contorted into such a shape that you can only push a mouse around with the heel of your palm, then perhaps you'll struggle, but for fingertip (or tentatively claw) control, this does just fine. After a few days as our primary mouse, we barely even noticed it was a compact design at all.

The whole of the Strix Carry's top shell can be separated from its magnetic clutch to reveal its guts, which comprise a pair of AA batteries (no Li-on cells here), a teeny USB wireless module nestled in a handy internal slot, and a pair of Omron switches for its main two buttons. These are socketed rather than being soldered in, and there's a replacement pair in the package (along with the requisite removal tool) should you wish to try out a different feel, or if you somehow click so frequently that you exceed their rated 50 million presses.

There's good grippy silicon on both sides, although, even at this small size, the shell has been molded in such a way that it's a distinctly right-handed mouse, with a pair of very thin and just adequate thumb buttons joining an excellent rubber-topped notched wheel in rounding out the control options. The tried-and-true Pixart sensor, in these crazy times, has half the sensitivity of the sensors in top-end gaming mice, but going beyond its 7,200 cpi would be overkill for all but the most twitch-wristed gamer. It coped perfectly well with all of our surface tests – this is a precision mouse.

In terms of connectivity, while there's no wired backup on offer, you can opt, via a base-mounted switch, for either Bluetooth or Asus's 2.4GHz wireless, which offers 1ms polling times at the cost of a slight hit in battery life. 1ms seems to be the new standard for peripherals, and when it works, it's wonderful – but when we ran the USB module next to another similar dongle (using Corsair's similarly fast 2.4GHz Slipstream technology), the input of the Strix Carry transformed into an unusably glitchy mess. Whether that was the fault of one module or another, it's certainly something to be wary of – Bluetooth solved the problem, but Bluetooth is really a secondary mode.

So, this has its potential issues. And while all component boxes are checked nicely, and it certainly functions well outside of those issues, we do also need to wheel around on ourselves and get contradictory: The ROG Strix Carry is probably the most boring device ever to land in the ROG line. That's a blessing, but it's also a curse – this is a good mouse, but we can't bring ourselves to get excited about it. ■

Alex Cox

Verdict

Small and entirely usable; discrete design; 1ms wireless.

★★★★☆

VIRTUAL REALITY HMD

$1,299 | HTC.COM/AU

HTC Vive Cosmos

Second generation virtual reality is upon us, so how does one of the originals in the scene follow up the popular HTV Vive?

After over three years on the market, HTC Vive is finally ready to retire its original VR headset, the HTC Vive, and replace it with a new model. In many ways, the HTC Vive Cosmos is a big leap forward from the original headset. But in other ways, it feels like a step in the wrong direction.

The Cosmos seems full of potential. It has great displays, is well-built with nice speakers that produce clear, loud audio, and the inside-out tracking system removes a handful of pain points that have stopped many from investing in VR – namely base stations. But the Cosmos also has a few glaring problems. It's more expensive ($1,299) and less comfortable than the original Vive. I also have critiques on the controllers, and the platform drivers leave much to be desired. All things considered, the Vive Cosmos is a good headset and worthy of your consideration if you're in the market for a new VR device. But it likely won't check all the boxes for you.

The Cosmos features a halo-style head strap (also known as a balanced crown), which puts the weight of the visor on your forehead and attempts to balance it with a rigid strap that clamps to the lower part of the back of your head. Like all halo-strap designs, the Cosmos includes a dial on the rear to adjust tension. However, my problem with the halo design is that you don't get as much wiggle room to find your visual sweet spot. With fabric head strap and deluxe audio head strap designs, you have the freedom to place the visor directly in front of your eyes and then position the strap where you need it to be. In order to get a good fitting with the halo design, the strap's position must take priority over your visual clarity.

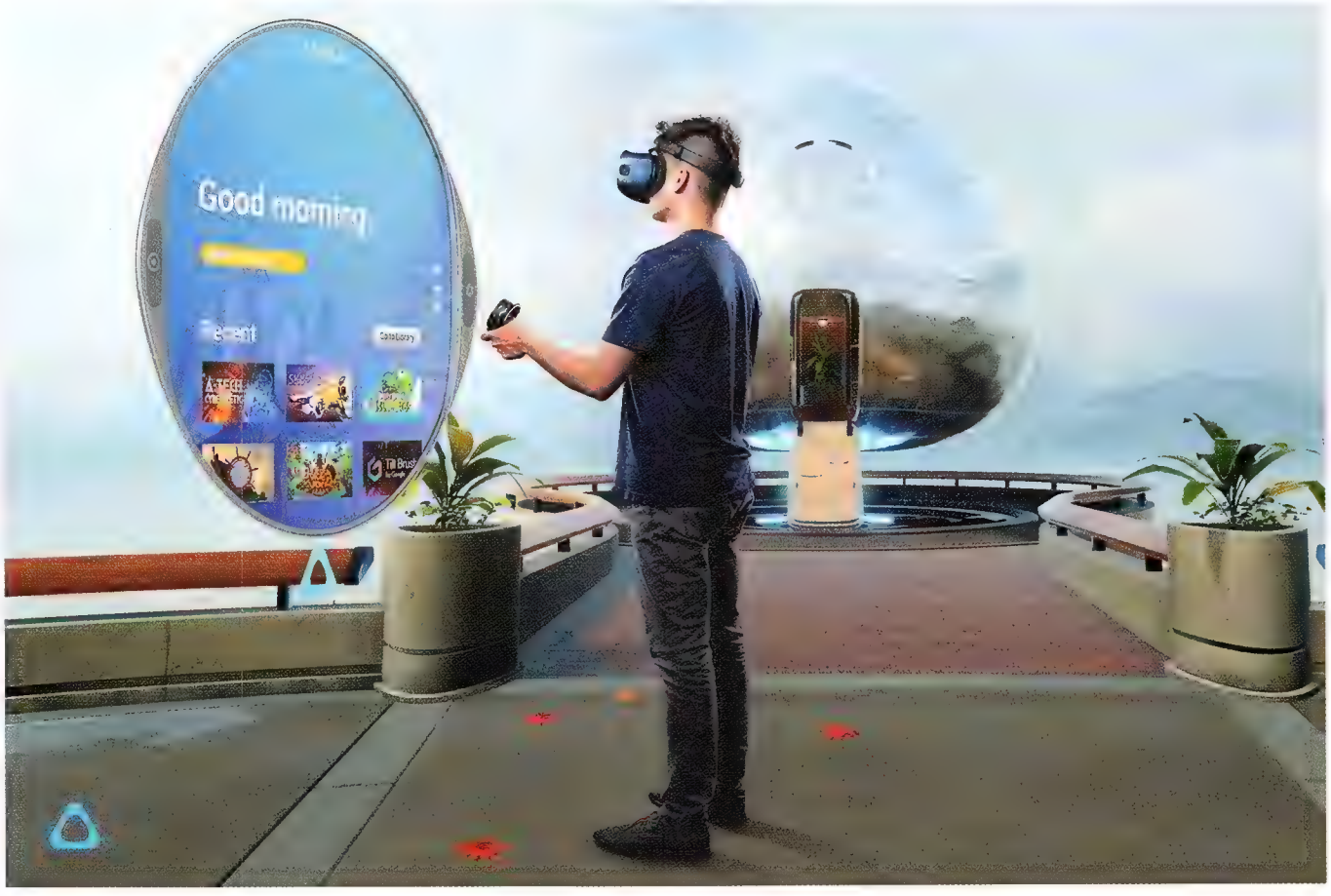
The Vive Cosmos features a much higher resolution than the original Vive headset, but thanks to software advancements HTC's latest headset doesn't require much more power than the outgoing device. The older headset could run on a PC with 4GB of memory. The Cosmos requires 8GB to function properly.

The Cosmos includes an integrated audio system, which is something I believe every VR headset should have. There's also a simple way to remove the headphones if you prefer to supply your own. Previous Vive audio solutions were removable but required a screwdriver and a process that wasn't very user-friendly. The Cosmos, however, features an incredibly simple clamping system that takes less than a second to remove but isn't likely to come apart accidentally.

The displays in the Cosmos headset produce some of the clearest images that I've yet seen in VR. The headset features two 3.4-inch LCD panels with a 90 Hz refresh rate and a combined resolution of 2880 x 1700. The Cosmos also boasts an RGB subpixel array, which further enhances the clarity of the image and helps to reduce the perceived screen door effect. The HP Reverb, with its dual 4K resolution RGB panels, still offers a higher overall resolution, but the Cosmos is easily as good as the Valve Index, with a slight increase in vertical field of view (FOV). Because the screens are LCD panels, you won't get the same deep blacks that you see with the Vive Pro's AMOLED panels.

The Cosmos is the first PC-based VR system from Vive that departs from Valve's Tracking solution. Instead, it features camera-based inside-out tracking, which means it doesn't require external base stations like the previous Vive headsets.

The Cosmos controllers are very similar to the new Touch controllers, which makes it easy for developers to offer input parity. They include a clickable thumbstick and X/Y and A/B buttons on the left and right controllers, respectively. They also have grip buttons for your middle finger and R1 and R2 shoulder buttons. Finally, each controller has a Vive



button, which triggers the Viveport software and SteamVR.

When gaming, the controllers were somewhat difficult to hold securely. The handles are pretty thick, and there's a bulky tracking halo. The controllers are comfortable enough, but I couldn't get a secure hold on them because there's nowhere to hold the controller with your thumb when you're not pressing a button.

The HTC Vive Cosmos isn't a perfect piece of hardware, but what is? Yes, the headset has a few shortcomings, but it's still a pretty great device. Going back and forth from the Cosmos to the HTC Vive Pro, Valve Index and Oculus Rift S gave me further appreciation for the Cosmos.

The Vive Pro is a well-built piece of tech but feels rickety in comparison to the Cosmos. I've tested the best VR headsets, and I can honestly say that I've yet to try on another headset that feels as high-quality as the Cosmos.

I have reservations about the Cosmos controllers' ergonomics, and I wish that more games worked with the controllers upon release (although this will likely change). Plus, there's no lens relief adjustment. However, those are pretty small concerns.

The Cosmos hardware isn't perfect, but for the most part it's an improvement over previous Vive headsets. The software, on the other hand, leaves a lot to be desired. When Vive first introduced the Viveport platform, it pitched it as an improved marketplace that would offer a better experience for consumers and higher revenue share for developers – presumably a win-win situation for everyone. However, the execution and delivery of Viveport hasn't lived up to the goal. That was never a problem before because the Vive and Vive Pro headsets were developed first for SteamVR, and Viveport was built around the headsets. The Cosmos is the first PC-connected headset that Vive designed for Viveport first, SteamVR second, but the Cosmos still requires SteamVR to function. During the setup process, you must either log into an existing Steam account or create a new one and install Steam. To access Viveport, you press the Vive button on the right controller, and to access SteamVR, you double-tap the Vive button on the left controller

As I said, no headset is perfect. However, the shortcomings of the Cosmos are worth looking past because the rest of the package is quite impressive and a notable improvement over the original HTC Vive.

Kevin Carbotte

Verdict

Excellent screens that cut it with the brilliant Valve Index, dispenses with base stations, controllers average.

★★★★½

HEADPHONES

$69 | WWW.CORSAIR.COM

Corsair HS35

Affordable cans with surprisingly little compromise.

There's always something. When you dip down below $100 in the headset market, you know you're going to be making compromises somewhere. Perhaps it'll be comfort, or sound quality, or features and functionality – there's always something. The trick for manufacturers operating at this price point is effectively disguising what that something is, so that when it eventually reveals itself, you don't mind much.

So it goes with Corsair's new HS35 headset, which takes a lot of design cues from the company's HS50 and HS70 cans, but keeps the outlay under $100. And it just happens that this one's especially good at playing down the inevitable compromises the pricing requires.

Starting with build quality, well sure, it's not encrusted with precious gemstones or elaborate RGB lighting arrays – and it's all the better for it. A mix of smart, understated black construction materials and finishes creates an overall look that speaks of a more expensive product, and while beauty is in the eye of the headset holder, we actually prefer this combo of matte and gloss plastic to the mesh finishes on the HS50 and HS70.

Rather than straying into the more experimental headband designs of Audio-Technica or SteelSeries, this HS35 is built around a lightweight aluminum band and padded with more than enough memory foam to keep the top of your head comfortable over longer sessions. There are memory foam pads around the earcups, too, but these feel less generous and – if you'll excuse the parlance – squidgy than the headband. That's not a big deal for the vast majority of users, but if you have bigger ears, you might find the chamber's slightly too shallow for you, and may experience some rubbing on the antihelix of your ear. And you thought the kids in the schoolyard calling you Dumbo was the worst of it.

Tipping the scales at 336g, this is among the lightest headsets on the market at the moment, so comfort shouldn't be an issue on all but the very biggest or most unusually shaped heads. Certainly, it remained barely noticeable on this tester's cranium for three-hour stints at a time, and that's a big one for the plus column. A 3.5mm cable connects the HS35 to your PC, which means there's no scope for tinkering within Corsair's useful and largely unobtrusive CUE software. We can live without that at this price, but it's something to note if you're used to creating custom EQ profiles or switching between presets depending on whether you're gaming or listening to your favorite drill remixes of classic kids' TV themes.

And that leads us on to sound quality, which brings a lot of bass to the party, thanks to those 50mm drivers, but ultimately compromises on overall clarity and warmth as a result. This isn't a massive deal, and shouldn't be taken to mean that games and those aforementioned drill bangers don't still sound great when they're being fed through the HS35. What it does mean is there's a slightly artificial sound to these cans that's more pronounced as you raise the volume, a bit like the digital "ring" you get from DTS: Headphone X in digital surround-compatible headsets.

We're seriously impressed with the build quality for the price, and wearing a headset you can forget is even on your head is a boon you'd pay three times this price for after a few hours wearing an uncomfortable model. ■

Phil Iwaniuk

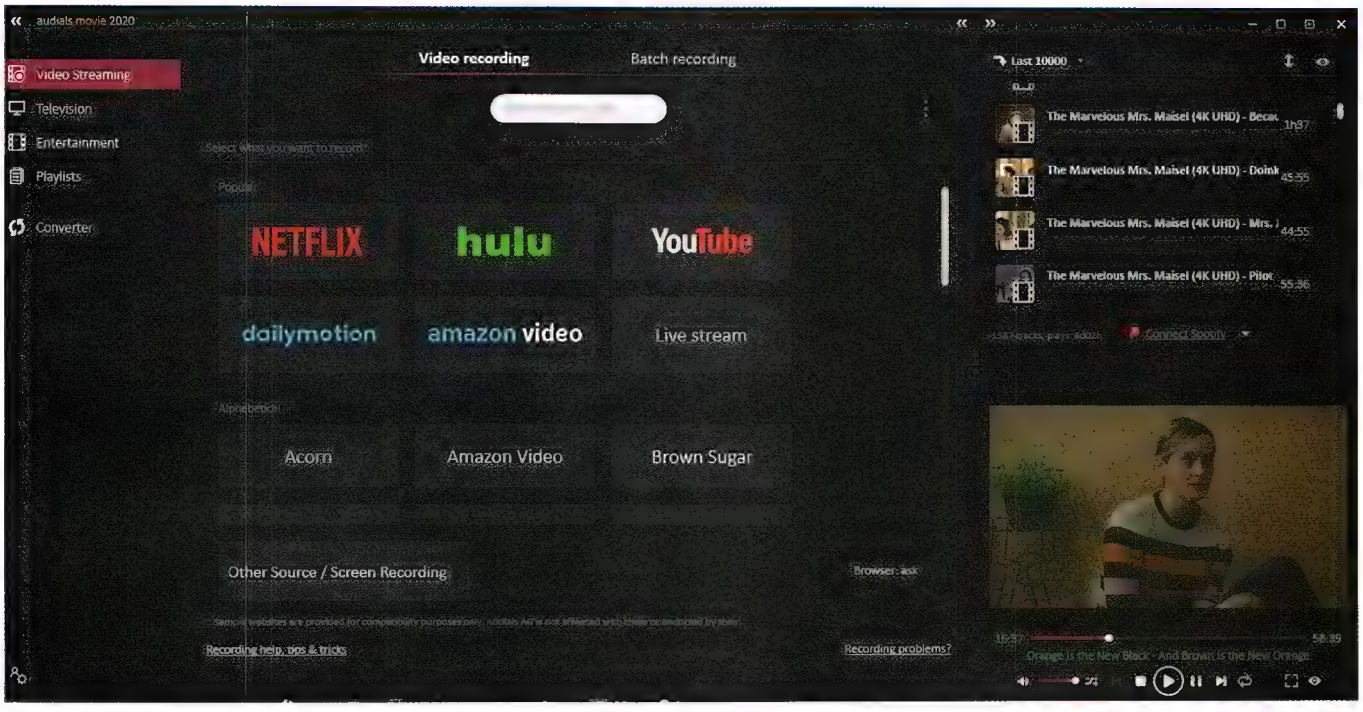
Verdict

Great construction quality; lightweight design.

software

» APPS FOR ALL YOUR PLATFORMS

Windows SOFTWARE



Audials One 2020

All your streaming services in one place.

$81 | AUDIALS.COM

The latest version of multimedia streaming software Audials One makes some welcome improvements on previous releases, with just a few quirks remaining from the 2019 version. If you're not familiar with the name, Audials One is essentially a one-stop shop for all your music, TV and movie streaming needs. You can use it to stream from Apple Music, Netflix, Amazon Prime Video, Spotify, and almost any other service you can think of, all through a single interface. It's fantastically convenient, and makes finding songs, shows and movies far easier than using a separate app for each service.

It's not all about streaming services, though; Audials One also recreates the time-honoured tradition of recording your favourite songs from the radio by letting you download tracks as they're played on thousands of online radio stations.

The software can 'listen out' for specific tracks in a wishlist and download them as they're played live. It's a slightly crafty way to expand your music collection, as recording from live radio stations is typically considered fair game (though laws do vary between countries). Audials has improved that autocomplete suggestions for wishlists in Audials 2020, which is a great timesaver.

Fancy listening to a radio station live, rather than just a single song? Again, Audials One has you covered. The sheer number of stations available could have been a nightmare to navigate, but thankfully the huge list is broken down into sensible categories (pop, rock, chillout etc), which are then split into more esoteric genres. You can also look for stations by country, and there's a solid search tool if you have something more specific in mind.

If a station plays an advertisement before playback begins, Audials One 2020 will label it with the word 'Ads' to warn you.

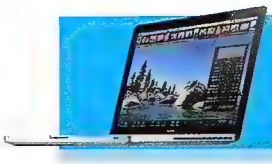
That's not the only new addition in the 2020 release, either; if you're a Spotify user, you'll be pleased to know that you can now drag and drop multiple playlists into Audials One, and download speeds are vastly improved.

On the video front, not only can Audials One 2020 pull in content from any streaming service you've subscribed to, it also lets you watch whole playlists without ads. Audials has worked with Google to make sure this feature is all above-board and legitimate, and it's far more convenient than trying to download videos one at a time using a standalone YouTube downloader.

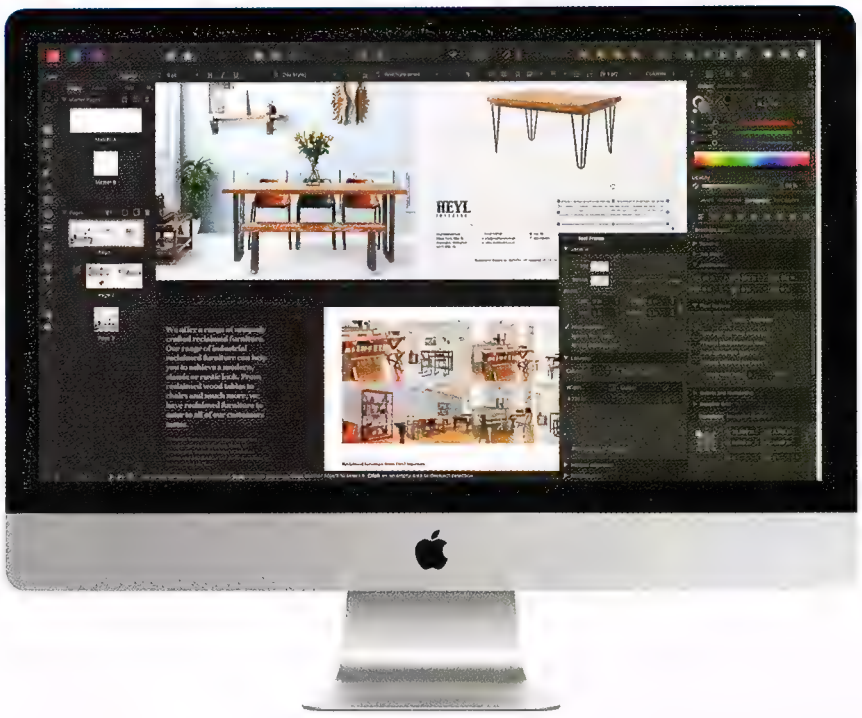
You don't have to search each streaming service separately, either. If you know what you'd like to watch, just type it into the main search bar and Audials One 2020 will find and pool results from all of them.

It's excellent to see Audials continuing to iterate and improve its software each year, taking feedback from users on board, and Audials One 2020 is its strongest release so far.

Catherine Ellis



Mac » APPS



Affinity Publisher has all the essential features of a professional page layout app.

Affinity Publisher

Design pro-quality pages for less.

$79.99 | AFFINITY.SERIF.COM
NEEDS MACOS 10.9 OR LATER

Behold – a brand new desktop publishing app for the Mac! Serif's Affinity series (Photo, Designer and Publisher) – developed from scratch for both Mac and PC, with Publisher expected to join the others on iPad too – was originally conceived with a page layout function at its heart, tying the whole creative process together neatly.

That's exactly what Publisher now does. If you buy all three apps (optional, but still over 50% cheaper than an annual subscription for InDesign alone), the StudioLink feature lets you switch to Photo or Designer tools while working in Publisher. To tweak a picture to better match other elements on a spread, for example, you can apply adjustments to it right there, instead of switching to an image editing app and trying to guess colour and placement without the page in view. It's something Adobe and Quark have tried to an extent, but here it really works. You can even open Publisher files in the other apps to edit relevant items.

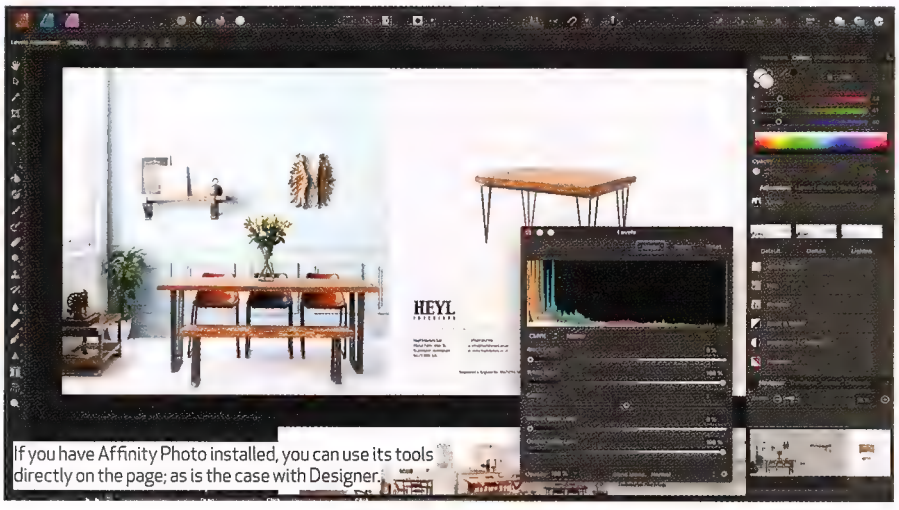
SMOOTH OPERATOR

Serif's uses Apple's Metal 2 to deliver exceptionally smooth performance on the latest Macs and iPads in Photo and Designer, as well as supporting Retina and DCI-P3 screens. But layout is less processor-intensive, and Publisher shows off even on older machines. On an ageing iMac that's regularly used for magazine pages, it put InDesign to shame, zooming smoothly in and out to further extremes than Adobe allows, and reflowing text around objects as we moved them.

The interface will feel familiar to those who've used InDesign or QuarkXPress. For file compatibility across the Affinity suite, it treats every item as its own layer, which makes for a lot of layers, but is ultimately logical. We fully expected to run up against limitations but all core features seem present and correct. An exception is digital publishing: there's no ability to add interactivity other than hyperlinks, no delivery platform, and no EPUB export. But we're OK with that.

Beyond the fonts supplied with macOS, you'll need to buy your own to use with Publisher. And Affinity's docked panel interface is a mixed blessing, making some settings visible that rivals hide in modular dialog boxes, but in other cases doing the reverse, splitting up status info that should be in one place, and lacking clear labelling for sets of options that aren't easily distinguished. Many InDesign key shortcuts are reproduced, but some important ones aren't, and there are minor failings like being unable to detach individual items from master pages. But with full typographical controls, grids and guides, columns and text flow, transparency effects, effectively infinite undo (with history saving) and more, this is a real DTP rival at last – and at a fraction of the price.

Adam Banks



If you have Affinity Photo installed, you can use its tools directly on the page; as is the case with Designer.

It's possible to create large, complex video productions on your iOS device.

Filmic Pro

Unlock the full potential of your iOS camera.

$22.99 | FILMICPRO.COM | NEEDS IOS 11.1 OR LATER (CERTAIN FEATURES RESTRICTED TO NEWER DEVICES)

Filmic Pro has won a number of awards for harnessing the power of Apple's iOS camera hardware. Indeed, some genuine feature films have been shot with this app.

The redesign introduces three shooting modes. The manual ARC sliders provide quick and easy control over focus, ISO, and shutter speed. These slide in on the left and right of the screen, and are simple to operate with your thumbs. A second mode provides on-screen selectors for focus and exposure control. Simply tap on an area to focus on it, or adjust exposure based on its brightness. The pro Hybrid mode lets you combine the previous two, and also has a digital zoom slider.

The app is well thought-out, with controls available via taps mainly along the bottom edge. A main menu pops out from the bottom right corner when tapped and provides access to key settings. These include app presets for dialling in a bunch of settings with a single tap, audio and video quality and stabilisation.

Resolution and frame rate will go as high as your device's hardware can manage; on more recent iPhones and iPads this includes 4K, 240fps, and more compressed formats. You can crop to various aspect ratios when shooting, either blanking out or overlaying the crop markers onto the screen, making it easy to frame shots.

VISUAL ANALYSIS

There are on-screen battery and audio level meters, and various input options, including Bluetooth mics. Advanced visual analysis can also be activated in the form of contrast peaking, zebra stripes, clipping, and false colour. Combined with the manual controls over ISO, shutter speed and exposure, they'll let you precisely set the look of a shot in a way the native Camera app doesn't. There's also a handy white balance selector with presets to quickly dial in colour temperature and tint.

There's a searchable library and the option to share clips or save to the Camera Roll. There's no editing – this is capture-only.

Surprisingly affordable for what it does, Filmic Pro is especially good to use on larger devices, and the results – with practice – are excellent. **Hollin Jones**

Just tap on the screen to select an area for metering exposure or focusing.

"Resolution and frame rate will go as high as your device's hardware can manage; on more recent iPhones and iPads this includes 4K."

Google Play » ANDROID

Hip Hop Kangaroo & Friends

Rappin' to the beat

FREE/$10.99 ALL UNLOCKS / HIPHOPKANGAROO.COM

Hip Hop Kangaroo & Friends is an app for young children that heavily promotes its main selling point: there are no ads. You can hand your pre-schooler a phone or tablet with this app running without worrying about them accidentally spending all your money or get influenced by advertising, providing they don't know how to close the app and jump onto YouTube. Which they might, I suspect, because as cute and nice as Hip Hop Kangaroo and his pals are, there's not a lot of stuff here.

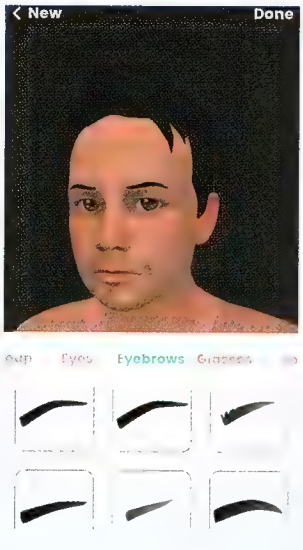
Your kids can watch videos of the eponymous kangaroo, along with his platypus and koala puppet pals, singing about the alphabet, counting, and exploring all over Adelaide. They can play around with sound boards, or take part in singalongs, and it's all charming. But even though the app was developed alongside teachers and educators to make sure that the content was educational and engaging, there's just not very many videos and activities in the app. Still, anything that keeps them away from that *Shrek* DVD for even one day is a blessing, right?

Virtual You

A 3D Me

FREE / HTTPS://WWW.HIGHFIDELITY.COM/

Virtual You is an app for a version of the present that still, to me, feels like the future. It's an avatar builder for VR environments built by High Fidelity, so that you can import yourself into virtual boardrooms, chat rooms, or even certain games. It takes a photo of you, scans it onto a face, and then lets you pick a hairstyle, eye colour, and your body type, plus dress it up. This sort of technology has existed for ages, of course, but I must give it up to Virtual You – I was a little creeped out, but then eventually delighted, by just how much my avatar looked like me, right down to the wispy moustache I grew after five days of not shaving. It takes a long time to load and transfer the avatar, and a lot of the clothing options mysteriously either didn't load in or were denied to me, but Virtual You is great at what it does. Even if you don't need a 3D avatar, it's worth a download just to see an uncanny 3D recreation of yourself.



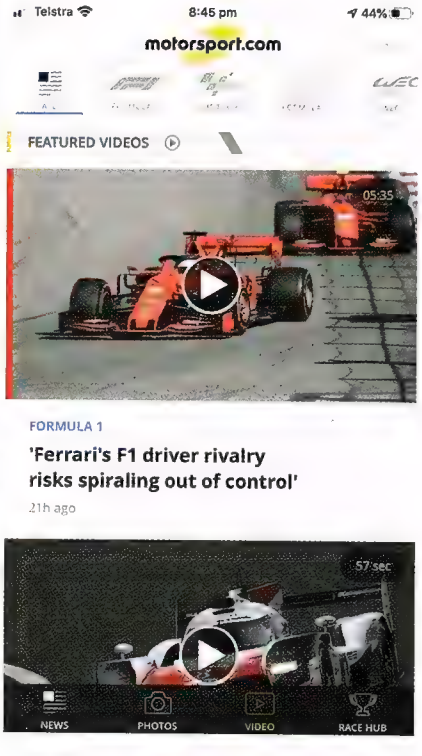
Motorsport.com

Vroom

FREE/ MOTORSPORT.COM

The world of motorsport can be hard to keep up with, especially if you want to be across all the different disciplines. **Motorsport.com**'s new app correlates all of the major website's text and video about Formula 1, MotoGP, Formula E, NASCAR, and all of the other major racing forms, into one handy, easy-to-use app. Website apps have a spotty history, but this app's collection of news, race fixtures and video is laid out easily so that you can navigate without issue. It sports a great design, and the native video player performs well. If you want an app that gives you immediate access to the most important race news of the day, this is great for that. There are some major downsides to the app, though, the most glaring of which is the lack of a search bar. If you're after news that happened a few days ago, you might well be out of luck. We also noticed that some of the categories on the website don't get their own tabs on the app – it's harder to follow esports on there, for instance. ■

James O'Connor



Voyager 10

Just like its namesake spacecraft that is the furthest of man-made probes, Mayank Sharma believes this distro will also go pretty far.

FREE | HTTPS://VOYAGERLIVE.ORG

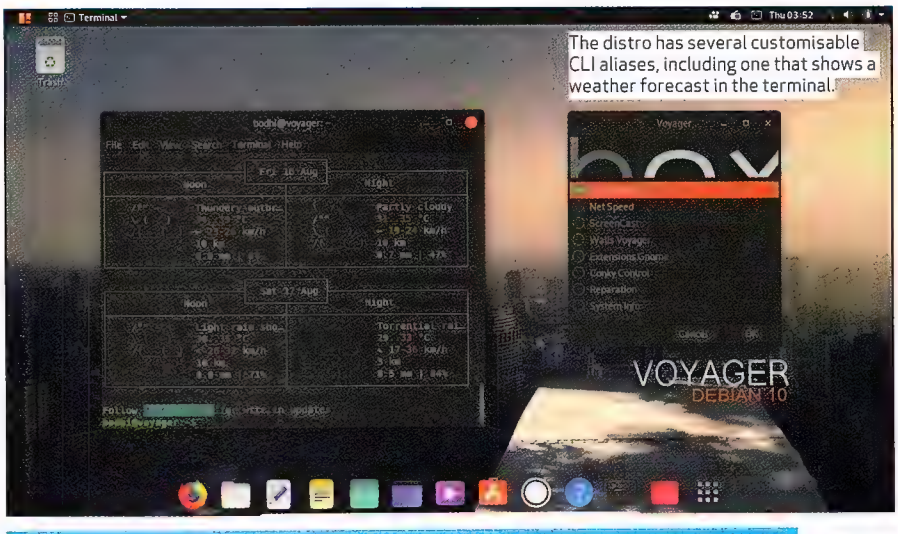
The Gnome 3 desktop offers several avenues for customisation, but we haven't come across a distro that makes good use of its malleability. Delivering a customised Gnome 3 desktop is one of the highlights of the French Voyager 10 distro, but we weren't really expecting much on this front, especially considering that this is Voyager's first Gnome-based release in over a decade.

The distro is available in two editions. The main edition includes non-free firmware and is available for both 64-bit and 32-bit computers. Since Debian 10 now supports SecureBoot, you don't have to disable the feature to get Voyager 10 to boot on UEFI-equipped machines. For the purists, the project also produces a version that only ships with free and open source firmware. This edition, though, is only available for 64-bit machines.

The editions are all Live-installable and boot to a pleasant-looking Gnome desktop. There's a Conky monitor applet on the left, and you can create icons on the desktop since the distro ships with the Desktop Icons extension enabled by default. The Gnome 3 Favourites bar is at the bottom, much like a dock, thanks to the Dash to Dock extension.

The list of apps has also been separated from the Activities Overview thanks to another extension. Besides these the distro ships with tons of other extensions: over a dozen are enabled straight out of the box, and quite a few are installed but haven't been enabled by default.

Voyager 10 bundles all the usual apps you'll want on a regular desktop distro, and then some. The inclusion of GRUB Customizer, Gnome Tweaks and SMTube are a nice and useful touch. For software management, Voyager uses the Gnome Software app that's configured to pull content from the official Debian main repository.



The distro has several customisable CLI aliases, including one that shows a weather forecast in the terminal.

"Voyager 10 bundles all the usual apps you'll want on a regular desktop distro, and then some."

CUSTOMISATION GALORE

Besides the desktop there are some other useful customisations as well. The right-click context menu in the file manager has a menu entry that rolls in several useful scripts for various tasks such as changing the ownership of a file, checking the hash of an ISO file and converting images from one format to another – all with a single click. The developers have also equipped the file manager with some plug-ins to help you quickly encrypt files and rotate and resize images.

The highlight of the distro is a custom app called Box Voyager that helps you tweak several aspects of the installation. Besides regular tasks like changing themes and switching wallpapers, you can use the app to enable the easyscreencast extension that simplifies the use of Gnome's built-in screencasting feature by placing a button in the top panel. Box Voyager also has controls to help you configure all aspects of the Conky monitor on the desktop. You can add more elements or turn it off altogether. The app also enables you do some spring cleaning by helping purge the cache. It can also fire up PhotoRec to recover deleted files and also enable a New Document option inside the file manager's context menu, with a handful of useful triggers.

But there are some rough edges as well, and the biggest in our opinion is the use of multiple installers. If you choose to install the distro from the boot menu, your request will be serviced by the Debian installer. However, you'll be greeted by the Calamares installer instead if you choose to anchor the distro to your disk from inside the Live environment. Although a majority of users would fire up the installer from within the Live environment, the duplication of installers isn't helpful, and we can't understand why it's touted as a feature on the project's website.

EVERYTHING YOU NEED TO KNOW ABOUT WI-FI 6

Wi-Fi 6 is here and promises big things for our wireless networks. Matt Hanson shares what to expect.

Wi-Fi 6 is probably the most exciting thing to happen to your wireless network in 2019. You'll probably start to hear the term increasingly bandied about by router makers and ISPs as we approach its launch, but what exactly is Wi-Fi 6, and how can it benefit you? Here, we take a close look at what Wi-Fi 6 promises and explain the impact it can make to home networks. We'll tell you everything you need to know about the standard, including how to upgrade your network to get the most out of the new tech.

You may have already come across Wi-Fi 6's previous name: 802.11ax. Thankfully, the Wi-Fi Alliance, a non-profit organisation that ensures Wi-Fi products meet certain standards, acknowledged that the former naming conventions were far too convoluted. As Edgar Figueroa, president and CEO of the Wi-Fi Alliance, explained: "For nearly two decades, Wi-Fi users have had to sort through technical naming conventions to determine if their devices support the latest Wi-Fi. The Wi-Fi Alliance is excited to introduce Wi-Fi 6, and present a new naming scheme to help industry and Wi-Fi users easily understand the Wi-Fi generation supported by their device or connection."

"Wi-Fi 6" is certainly going to be a lot easier to remember than "802.11ax," which supersedes 802.11ac (now known as Wi-Fi 5). It brings the naming convention more in line with 3G, 4G, and 5G. Going from Wi-Fi 5 to Wi-Fi 6 is a clear upgrade – whereas it's not clear whether 802.11ax is newer or older than 802.11ac. We're certainly glad of this new naming convention.

If your current router is only a few years old, it's likely to be a Wi-Fi 5 model. While Wi-Fi 6 is backward compatible with older devices, you'll need a Wi-Fi 6 router to benefit from the full potential of the new technology.

WHEN'S IT COMING OUT?

Earlier this year, a Wi-Fi 6 certification program was announced for devices to support the new standard, stating that products need to offer several features and meet certain criteria to be Wi-Fi 6 certified, with the program starting in the third quarter of 2019 – and it's underway right now.

In fact, Wi-Fi 6 capable devices were on display as early as the Consumer Electronics Show (CES) in Las Vegas in January of this year, and you might have noticed that some Wi-Fi 6 routers have already gone on sale – including the Netgear Nighthawk AX8 and AX4, TP-Link's Archer AX6000, and the Asus RT-AX88U. These early devices generally still have the 802.11ax labeling, though.

Does that mean you can go out and buy a Wi-Fi 6 router today? Well, not quite. These early routers are based on the draft standard of Wi-Fi 6, which at the time of their release has not been finalised. If certain aspects of the certification change, then these early routers may miss out on features that other Wi-Fi 6-certified devices boast. As always with early adopters, it's a risk you'll have to take if you want the new technology as soon as possible.

WHAT DO I NEED FOR WI-FI 6?

Of course, having a Wi-Fi 6-capable router is only the first step toward benefitting from the new technology. While your older Wi-Fi products will be able to connect to a Wi-Fi 6 router, to get the features of Wi-Fi 6 (which we'll get to in a moment), you'll also need Wi-Fi 6-certified devices. And at the moment, those are rather thin on the ground.

The good news, though, is that we should start seeing a steady stream of Wi-Fi 6-enabled devices hitting the market. Most flagship smartphones will feature the technology – for example, the Samsung Galaxy S10 is the first smartphone with Wi-Fi 6 built in. At the moment, Wi-Fi 6 could be confined to the more expensive handsets, but hopefully that will quickly change as Wi-Fi 6 adoption grows.

We should also see numerous Wi-Fi 6 laptops coming to the market in the near future, with major manufacturers announcing Wi-Fi 6-equipped notebooks back at CES.

WI-FI 6 SPEEDS

Wi-Fi 6, like other leaps in Wi-Fi technology, brings improvements to both the speed and coverage of wireless networks, but what kind of speeds should we expect from Wi-Fi 6? Early figures suggest that we could see speed boosts of around 30 percent over Wi-Fi 5.

That's a pretty decent improvement, and Wi-Fi 6 should theoretically offer speeds of up to 10Gb/s. While that's still not enough to challenge wired networks, you could see a decent jump in speeds if you're upgrading from Wi-Fi 5.

Wi-Fi 6 will achieve these speeds by fully utilising the 2.4GHz and 5GHz bands at the same time. By combining the bands, rather than keeping them separate, as in previous Wi-Fi generations, and using MU-MIMO to increase the capacity of the network, Wi-Fi 6 could be a seriously tempting upgrade for anyone who's frustrated with the sluggish performance of their Wi-Fi network. The improved

Asus has already launched a number of Wi-Fi 6 routers.

"Most flagship smartphones will feature the technology – for example, the Samsung Galaxy S10 is the first smartphone with Wi-Fi 6 built in."

MU-MIMO (multi-user, multiple input, multiple output) features of Wi-Fi 6 will allow eight users on both up and downlink (Wi-Fi 5 only allows four users at once on the downstream). However, there are rumors that this feature may not be present at launch – another reason why early adopters might be wiser to wait until Wi-Fi 6 is more established.

Wi-Fi 6 will also eventually make use of the 1GHz and 6GHz bands when they become available, and the widening of the spectrum will allow for more bandwidth, which can then be split into sub-channels, smartly routing connections between devices for better speeds.

Because of this, people who use Wi-Fi 6 in congested environments – for example, households with lots of different Wi-Fi-enabled devices all vying for an Internet connection – will likely see the biggest leap in performance.

With the number of smart devices in our homes (which require an internet connection) constantly increasing, Wi-Fi

Look for the above logo for Wi-Fi 6-certified hardware. The Wi-Fi Alliance has simplified Wi-Fi naming conventions in general.

Netgear's excellent Orbi routers are getting a Wi-Fi 6 upgrade

6 could be a real game changer – quite literally, if you have a house full of *Fortnite* addicts.

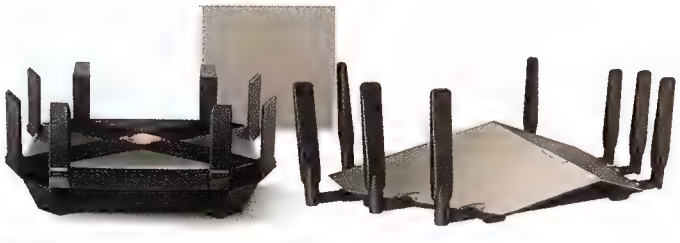
It's not just in your home that Wi-Fi 6 can help with congestion, however. If you live in a street or apartment complex with a lot of competing wireless networks, some of the clever technology introduced with Wi-Fi 6 can help reduce conflicts with your neighbors' wireless networks.

One such technology is BSS (Base Service Station) Color. This identifies and marks frames from neighboring networks that don't originate from your household, allowing your router to effectively ignore them. It's a rather elegant way of ensuring that signals from nearby networks don't interfere with each other.

BANDS ON THE RUN

The fact that Wi-Fi 6 should in the future make use of additional bands alongside 2.4GHz and 5GHz is big news. For what seems like ages, many routers have been providing those two bands. The problem is, 2.4GHz has long been overcrowded with consumer electronics, as so many older or budget devices use that band. Meanwhile, 5GHz isn't just getting more crowded as more devices are released that use that band, but its spectrum is too limited to support wider bandwidth channels. Not only that, but parts of the 5GHz spectrum are still restricted in how they are used.

This has lead to many manufacturers pushing to expand the number of bands available for Wi-Fi devices, with a proposal by some of the biggest names in networking suggesting that the 6GHz band would be "essential to meeting demand for the next generation of wireless broadband services." Fans of wordy, overly technical documents can read the entire proposal at **http://bit.**



TP-Link and D-Link have both announced Wi-Fi 6 routers.

© TP-LINK, D-LINK, NETGEAR

WI-FI 6 ROUTERS

All the big router manufacturers have Wi-Fi 6 routers available already, or are due to launch them imminently. For example, Asus's RT-AX88U is the company's first Wi-Fi 6 router. It's dual-band and offers up to 6,000Mb/s of Wi-Fi throughput, along with four antennas, and eight LAN ports. It costs $525.

Asus also has the gaming-oriented ROG Rapture GT-AX11000, a tri-band router that can keep one 5GHz band dedicated to gaming, and costs $750. There's also the Asus AiMesh AX6100 Wi-Fi System, which is a mesh Wi-Fi system that can cover the whole home. It should launch around the time you read this issue.

As one of the biggest names in networking, it's no surprise that Netgear is going all-out on Wi-Fi 6, and the company has a number of Wi-Fi 6 routers already available. The Netgear Nighthawk AX8 (RAX80) offers eight streams of wireless connectivity, 160MHz channel support, and 6,000Mb/s throughput over two bands. It also looks like something you'd expect a Sith to fly around in. It's available now for around $500.

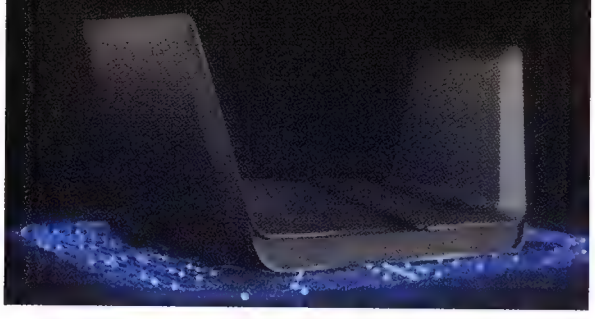
The Netgear Nighthawk AX12 (RAX120) ups the ante with 12 Wi-Fi streams, plus Alexa and Google Assistant support, and Netgear claims it's the most powerful router the company has ever produced. It is also available now for around $750.

Netgear is also updating its excellent Orbi mesh Wi-Fi system to support Wi-Fi 6, which the company claims will offer gigabit speeds across the entire mesh network, with the ability to handle 12 streams at once, along with MU-MIMO and OFDMA support.

D-Link was early to the Wi-Fi 6 game, launching a number of devices back in 2018. It's also got a new Wi-Fi 6 router, the D-Link DIR-X6060, which is due to launch some time in 2019.

TP-Link has a few Wi-Fi 6 routers, too, including the Archer AX6000 (available now for $450), Archer AX11000 Tri-Band Wi-Fi Gaming Router (available in Australia late 2019), and the Deco X10 Mesh Wi-Fi System, which is also due to launch late 2019.

As you'd expect, Netgear is pushing Wi-Fi 6 hard.



WI-FI 6 SMARTPHONES

You can have any brand of Wi-Fi 6 smartphone... as long as it's Samsung (for now).

If you're after a Wi-Fi 6-enabled smartphone, your choices at the moment are pretty limited. Basically, you'd better like Samsung phones. The Samsung Galaxy S10 family of smartphones were the first handsets to support Wi-Fi 6, and this includes the Galaxy S10, S10 Plus, and the (slightly) more affordable Galaxy S10e. Meanwhile, the Galaxy S10 5G offers both Wi-Fi 6 and 5G support, making it the best smartphone if you want to experience the latest network technology. These phones don't come cheap, however. The S10 costs $1,349 for the 128GB model, and features a 6.1-inch QHD+ screen, 8GB of RAM, and a triple-lens rear camera, with a 12MP regular lens, 12MP optically zoomed telephoto lens, and a new 16MP ultra-wide lens. Meanwhile, the S10 Plus costs a huge $1,200 for the 128GB version, and packs a 6.4-inch QHD+ screen, 8GB or 12GB of RAM, and that same triple-lens camera. Even the supposedly more affordable Galaxy S10e is still a very pricey proposition at $780 for the 128GB version, which comes with 6GB of RAM, a 5.8-inch 1080p screen, and dual-lens camera. As Wi-Fi 6 adoption grows, we should see a wider range of smartphones from a variety of manufacturers being released with Wi-Fi 6 support, and we hope that the new Wi-Fi technology won't be confined to ultra-expensive flagship smartphones either – we'd love to see it appear on more affordable handsets. At the time of writing, Apple has just released its new iPhone 11 smartphones, and while there were rumors circulating that the handset will feature both 5G and Wi-Fi 6 connectivity, it turns out that this generation wasn't ready for 5G just yet. They do support Wi-Fi 6 though – great news if you're not a fan of Android. While smartphone manufacturers are understandably more excited about 5G support than Wi-Fi 6, our phones are probably the devices we use the most to connect to Wi-Fi networks, so we hope they embrace the new technology with future handsets.

ly/6GHzProposal. The bottom line is that Wi-Fi networks need more space. If you think of networks as roads, the more data (vehicles) there is, the more congested they become. Adding additional bands would be similar to opening up more lanes on a highway, to allow traffic to pass more easily.

It looks as though, with Wi-Fi 6, those demands for more bands will be met. This could be one of the most important changes the new technology ushers in – particularly because of our increasingly congested wireless networks. So, while there will be an improvement in speeds with Wi-Fi 6, it seems as though the bigger focus with the new technology is making sure that Wi-Fi networks have enough capacity to support the demands of modern connected homes, where every smart device needs a fast and stable internet connection.

Plus, with home broadband speeds getting ever faster (for those of us lucky enough to live in areas with decent infrastructure, at least), there's an added pressure to ensure that our Wi-Fi networks don't become bottlenecks for ultra-fast fiber broadband.

EXPANDING COVERAGE

Another key advantage of Wi-Fi 6 will be expanding the coverage of Wi-Fi networks. For anyone who's had to put up with a wireless network that struggles to reach certain parts of the home, this will be good news.

One way that Wi-Fi 6 is improving coverage is with beamforming. While Wi-Fi 5 also boasted beamforming functionality, it could only support four antennas, while Wi-Fi 6 can support eight. Beamforming essentially directs Wi-Fi signals toward specific devices in various places, ensuring that those devices get the best possible connection to the wireless network. This is particularly important for devices that move around a lot – such as smartphones and tablets, which are carried around your home.

Wi-Fi 6 can also offer wider coverage (and greater stability) thanks to its longer OFDM symbol. Now, this gets a bit technical, but OFDM is a way of transmitting data by dividing it among smaller sub-carriers. With Wi-Fi 6, the OFDM symbol is four times longer, which means there are four times as many sub-carriers, increasing both coverage and speed. To cut a long story short (and skip over a lot of jargon), it should mean that a Wi-Fi 6 network will reach Wi-Fi 6 devices over a much wider area, such as multiple floors in a house, while remaining fast and stable.

We hope to see Wi-Fi 6 laptops soon as well.

Wi-Fi 6 is also more efficient thanks to OFDMA (Orthogonal Frequency-Division Multiple Access), which is brand new for Wi-Fi 6, although the technology has been used in 4G LTE networks. Essentially a multi-user version of OFDM, it allows up to 30 clients to share a channel (rather than waiting for the channel to become available), and can combine different types of network traffic. Router maker TP-Link explains the technology by comparing Wi-Fi connections to a series of delivery trucks that deliver data packets to your devices. In previous versions of Wi-Fi, these delivery trucks could only deliver one parcel to one device at a time. However, with Wi-Fi 6 and OFDMA, each truck can deliver multiple parcels to multiple devices simultaneously. In the real world, this would certainly speed up Amazon deliveries, but in the case of Wi-Fi 6, it leads to more efficient data delivery, and could help boost the speeds of uploads and downloads.

BETTER BATTERY LIFE

You might not realise it, but how your device connects to Wi-Fi networks can be one of the biggest drains on its battery life, and with Wi-Fi 6, the Target Wake Time (TWT) feature makes this more efficient. It helps control when mobile devices wake up to send and receive wireless data, and by better managing this, those mobile devices can remain in their sleep state for longer. This, in turn, leads to noticeably longer battery lives for your mobile devices.

This technology will also benefit low-powered Internet of Things (IoT) devices. With our homes becoming ever more packed with this kind of smart gadget, this is good news.

SHOULD YOU BE EXCITED?

For many people, Wi-Fi is something that's always there and, most of the time, just works, so it can be difficult to get excited about it. However, there are some scenarios where Wi-Fi 6 can really make a difference. If you live or work in an area with a lot of competing wireless networks, or your home is full of devices (and people) all hammering the Internet, Wi-Fi 6's increased speeds and bandwidths can be a real bonus. Plus, as our homes become ever more connected with an increasing number of smart devices, while we also demand more from our networks and internet connections, thanks to 4K streaming (and upcoming game streaming services such as Google Stadia will add to that strain), Wi-Fi 6 will seem ever more essential. ■

Few smartphones support Wi-Fi 6, but we hope that changes soon.

INDUSTRY PERSPECTIVE

Why should we get excited about Wi-Fi 6? We chatted to Lionel Paris, Director of Product Marketing, Consumer Products, at Netgear, about how Wi-Fi 6 can upgrade our home networks.

"Wi-Fi 6 is exciting in a number of ways. Although Wi-Fi has been around for 20 years, understanding it has always been a challenge for consumers. This year, the Wi-Fi Alliance has answered the need for clarity by using numbers (4, 5, and 6) to differentiate Wi-Fi generations. It's a lot easier to understand the step up from Wi-Fi 5 to Wi-Fi 6 than 802.11ac to 802.11ax, so we're really pleased about that progress. Not only that, but it will help with educating consumers on the different speeds and versions available, to ensure that when it's time to upgrade, they'll know they are buying the latest standard.

"As you might expect, Wi-Fi 6 brings major improvements in both speed and coverage. While each improves up to four times, of equal importance is that the new standard is much better equipped to deal with the modern home full of connected devices. With the average home predicted to have 50 connected devices by 2023, it's crucial to bring in a standard that has the capacity to deliver great performance under increasing demand."

"As you might expect, Wi-Fi 6 brings major improvements in both speed and coverage."

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- ELIMINATE THREATS TO YOUR PC

PAGE 57

SEEK AND DESTROY WINDOWS 10 MALWARE

DISCOVER HOW TO PROTECT YOUR PC FROM MALWARE, PLUS HOW TO GET RID OF ANY INFECTIONS THAT SNEAK THROUGH.

PAGE 66

BLOCK LINUX RANSOMWARE

JONNI BIDWELL KNOWS HOW NOT TO DO A LOT OF THINGS, INCLUDING HOW NOT TO PAY RANSOMS AND HOW NOT TO BE FOOLED BY SOCIAL ENGINEERING SCAMS...

Seek and destroy WINDOWS 10 MALWARE

Discover how to protect your PC from malware, plus how to get rid of any infections that sneak through.

Unless you've lived under a rock your whole life, you'll have come across malware at some point, whether it came to you via floppy disk or a dodgy website. The question remains, how do you protect yourself against it, and what can you do should you find your PC infected? In this feature we'll answer these – and other – questions.

We'll open with a quick run-through of the most common forms of malware you're likely to encounter, from traditional worms and Trojans to backdoors, rootkits and ransomware. We'll then help you perform a security audit of your PC – you'll find Windows 10 is much better at protecting you than earlier versions of Windows, but there's still room for improvement.

Then it's on to the tricky question: what do you do when an infection sneaks through your defences? We'll step you through the techniques and tools you'll need to not only wrest control of your computer back from whatever malware has invaded it, but also start to clean up the mess it leaves behind.

These days you're under threat online too – we'll finish by taking a look at ways you can avoid being targeted when using the internet, boosting privacy and security and making the web and other online activities a safer, more pleasurable experience once again.

Threats to your PC's security

Receive a complete rundown of the key dangers – malware, hackers and more – that threaten your PC.

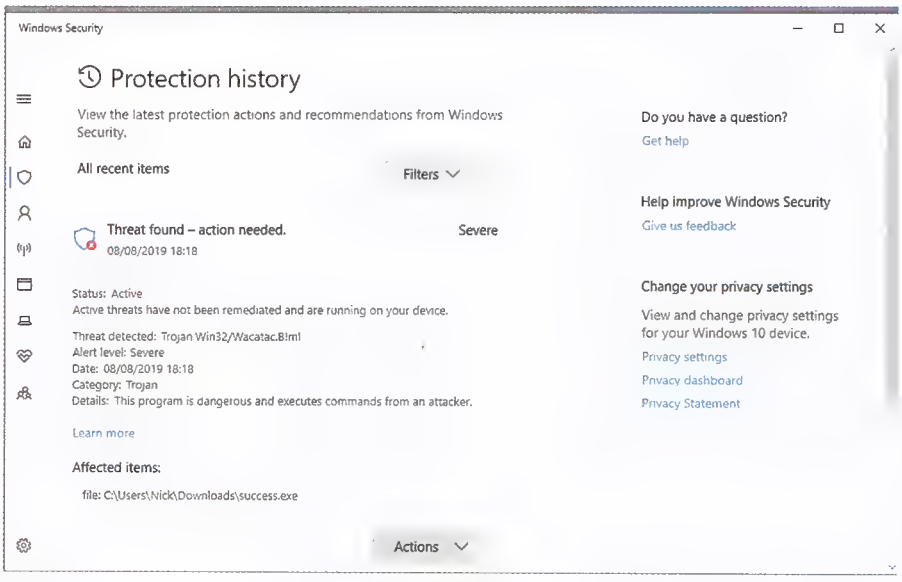
Threats to your privacy and security come in many shapes and forms these days. Let's start by taking a brief tour of the different types of malware around to provide you with a better understanding of what to look out for.

VIRUS/WORM

Traditionally malware was conflated with the term 'virus'. However, viruses are a specific form of malware: code inserted into other files (such as macros in Microsoft Office documents, which is why macro supported is now disabled by default in Office). Along with worms – standalone programs rather than malicious code hidden inside other files, viruses are primarily a mechanism for delivering so-called malicious 'payloads', and are designed to replicate themselves as far and wide as possible, such as through copying to shared network folders or hiding inside emails.

TROJAN HORSES

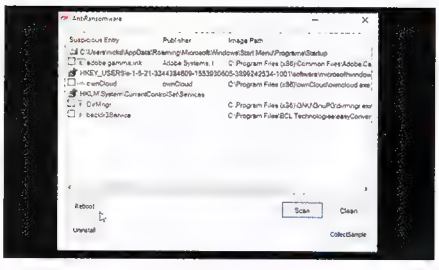
These days, a more common form of malware comes under the 'Trojan horse' heading. As the name suggests, they're called Trojans because they attempt to sneak on to your PC under false pretences, typically by masquerading as legitimate software. Once installed, they can deliver different kinds of payloads, from changing system settings to prevent you from detecting and removing the threat to spying on your activities and downloading more malware to your PC.



Malware comes in all shapes and sizes, with some Trojans more dangerous than others. Windows Security provides ratings for each.

ZERO-DAY EXPLOITS

The never-ending release of security updates for Windows, web browsers and other software are a constant reminder that security holes are constantly being discovered – these holes make it possible for hackers to inject malware or take control of

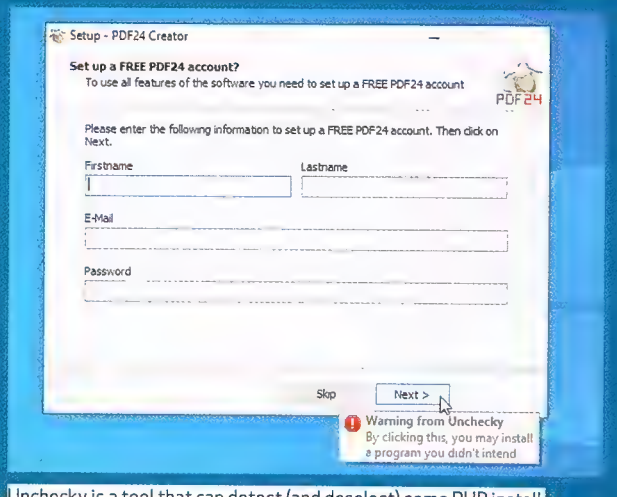


Dedicated anti-ransomware tools are available, but the trick is obviously to avoid ever being infected.

POTENTIALLY UNWANTED PROGRAMS

One grey area when it comes to malware is that related to Potentially Unwanted Programs, or PUPs. Some application installers offer you additional programs, toolbars and other software during the set-up process – most are perfectly legitimate, but there are question marks over the practice. This so-called 'bundleware' is used to help fund development of programs, ensuring they remain free of charge, but the practice can be abused.

Most PUPs are harmless – and definitely not malware – but some can harbour spyware, browser hijackers and other unwanted programs. The major problem is that they're often pre-selected for installation by default, and the terminology for rejecting the offer can be confusing. What exacerbates the problem is that most security software ignores program installers that offer PUPs as they technically require your authorisation – however poorly framed – before they can be installed. Two programs that can help keep PUPs off your PC are the premium version of Malwarebytes Anti-Malware (see over the page) and a free program called Unchecky (**www.unchecky.com**), which we recommend for all users.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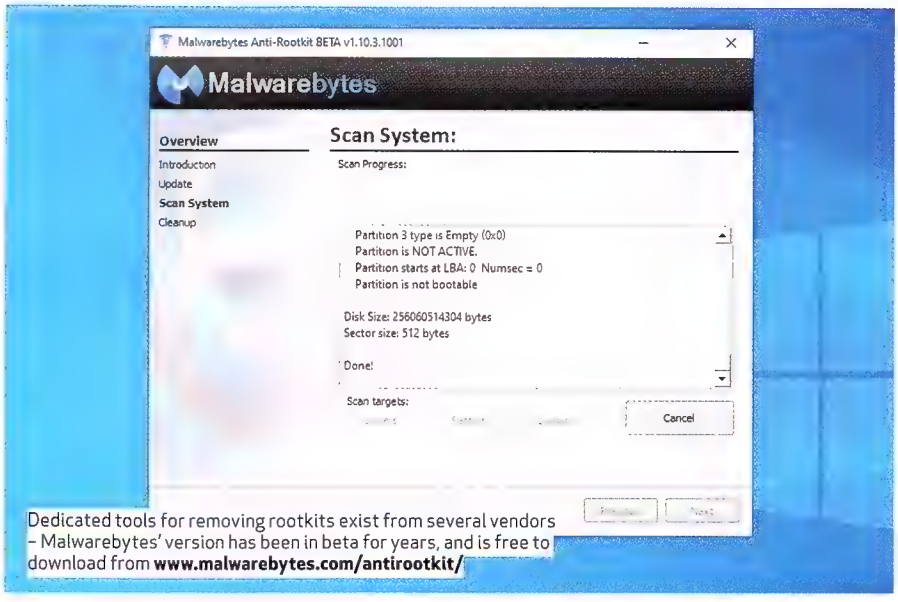
Password
Skip
Next >
Warning from Unchecky
By clicking this, you may install a program you didn't intend

Unchecky is a tool that can detect (and deselect) some PUP install options, plus it will warn you about others.

compromised systems using zero-day exploits. The 'zero day' is a reference to the time it takes between discovering a hole and patching it. People's reluctance to install security updates, thus increasing the risk from zero-day exploits, is one of the reasons why Windows 10 makes such updates mandatory.

Zero-day exploits can carry all kinds of malware payloads, and your best bet for protecting yourself in the interim between discovery and patching is to ensure your security software has built-in protection against them using heuristics, which acts on suspicious behaviour that may indicate the presence of malware.



Dedicated tools for removing rootkits exist from several vendors – Malwarebytes' version has been in beta for years, and is free to download from **www.malwarebytes.com/antirootkit/**

BACKDOOR

An infection that allows hackers – typically automated scripts or other infected computers (known as zombies or 'bots') to remotely access and control your PC. Delivered by worms and Trojans, they can do anything from use your computer to deliver spam, steal personal information or act in conjunction with other infected PCs (collectively known as 'botnets') to attack major online services through Distributed Denial of Service (DDoS) attacks.

SPYWARE

While traditional viruses aim to replicate themselves far and wide, spyware tends to exclusively focus on the computer it's been installed on. Its primary aim is typically to collect information about you – through spying on your usage – often to target you with ads and other material for financial gain. It's also often used to steal sensitive information such as financial data and passwords through the use of a keylogger, which monitors keystrokes and mouse movement.

Like other forms of malware, spyware also attempts to change computer settings – particularly internet-based settings. This is to both protect itself by making it impossible to visit security-based websites, plus make use of whatever information it's gathered.

ROOTKITS AND RANSOMWARE

Rootkits are a special form of malware that's designed to conceal its own presence – in the form of tell-tale processes and running programs – and actively protect itself from being removed by security software. Thus hidden, the rootkit can then introduce payloads that can steal user information or even hijack the computer for use as part of a larger botnet network.

Ransomware is even more insidious. It seizes control of your PC and demands you pay to restore control (or decrypt personal data). It's delivered in many different ways, from regular infections and other vulnerabilities (such as backdoors) to phishing – tricking users into running programs. Unlike other malware, it makes no attempt to hide.

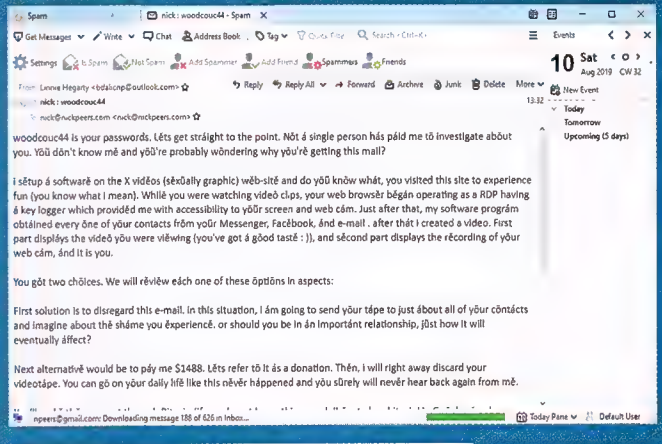
Once triggered, you're either locked out of your entire PC or key parts of the system, and you may find all personal files are encrypted, spreading to any connected network shares and backup drives. You'll receive regular prompts – and a deadline – to pay an online ransom in return for an unlock code that (in theory) removes the restrictions and restores control or your data.

BEHAVIOURAL THREATS

As you'll see over the page, it's increasingly tricky for malware to infect your PC with little or no resistance. That's why modern malware is increasingly based on deception, designed to trick you into clicking a web link or opening an infected file.

Many of these so-called phishing attempts originate from emails or instant messages. They attempt – with varying degrees of success – to make themselves look genuine, with the aim of getting you to open a file or click a link to visit a fake website where you're asked to enter sensitive security information to 'verify' your details. In actual fact, what you enter is captured by the hacker.

There is also a growth in emails claiming to have hacked the user's computer. They claim to have recorded – using your PC's webcam – evidence of you enjoying pornographic websites and aim to make themselves more plausible by inserting an old password stolen from website breaches that's associated with your email account. Most of these phishing emails are caught by spam filters, but occasionally a few will sneak through. Do not respond to any of them.


Spam
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Upcoming (5 days)
woodcouc44 is your passwords. Lêts get straight to the point. Nôt á single person hás páid me tô investigate abôut you. Yôü dôn't know mê and yôü're probably wôndering why yôu're getting this mail?
i sêtup á softwarê on the X vidêos (sêxûally graphic) wêb-sitê and do yôü knôw whát, you visited this site to experience fun (you know what I mean). Whilê you were watching videô clips, your web browsêr bêgán operating as a RDP having á key logger which providêd me with accessibility to yôûr screen and web cám. Just after that, my software prográm obtáined every ône of yôur contacts frôm yoûr Messenger, Facêbook, ánd e-mail . after thát I created á video. First part displâys the videô yôu were viêwing (you've got á gôod tastê :)), and sêcond part displays the rêcording of yôur web cám, ánd it is you.
You gôt two chôices. We will rêviêw eách one of these ôptiôns in aspects:
First solution is to disregard this e-mail. in this situation, I ám going to send yôur tápe to just ábout all of yôur côntácts and imagine about thê shâme you êxperiencé. or should you be in án importánt relationship, jûst how it will eventually áffect?
Next alternativê would be to páy me $1488. Lêts refer tô it ás a donation. Thên, I will right away discard your videotápe. You can gô on yôur daily lifê like this nêvêr háppened and yôu sûrely will nevêr hear back again from mê.
Today Pane
Default User
Behavioural threats tend to originate mostly from emails attempting to trick you.

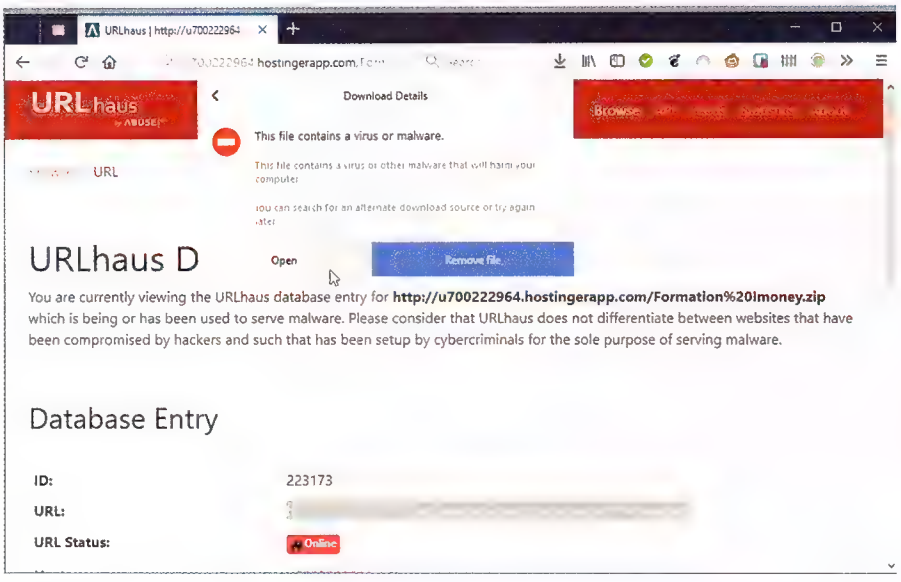
Strengthen your PC's security

Audit your current security and find ways to add extra layers of protection to keep malware at bay.

When it comes to protecting your Windows 10 PC, both antivirus and firewall protection are built into the operating system, and while it's strictly no-frills, Windows Security is capable of keep most malware off your system. We tested it with a range of live malware samples, and it detected them all, throwing up a warning dialog offering to remove or quarantine the malware in question.

Windows itself is also packed with malware-thwarting technology too. User Access Control (UAC) is the confirmation dialog you see whenever you open a file or program that wants administrative access to your system. Windows 10 also introduced the SmartScreen filter, which automatically pops up a warning about program files that aren't digitally signed. Many are legitimate, but it provides you with an extra step of protection. The filter will go even further if it detects known malware, with the dialogue box turning red instead of blue and the warning made crystal clear.

Most malware originates from the internet, which is why your web browser has a role to play too. All modern browsers – including Microsoft Edge – will screen any file after it's been downloaded for potential malware, alerting you if it's known malware. Some browsers, such as Firefox, will even flag a file that's not been downloaded or opened by many people – this should ring alarm bells if you're downloading well-known software from a less reputable website. It suggests the file may have been tampered with, so cancel the download and source it from a safe location, such as the program's own web pages or a trusted mirror.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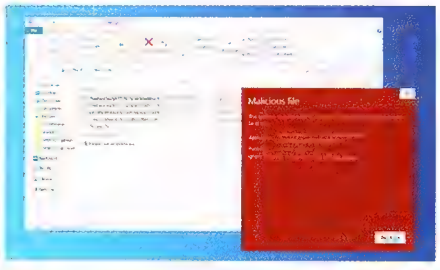
which is being or has been used to serve malware. Please consider that URLhaus does not differentiate between websites that have been compromised by hackers and such that has been setup by cybercriminals for the sole purpose of serving malware.
Database Entry
ID:
223173
URL:
URL Status:
Online

Browsers also attempt to keep you away from dangerous websites like those involved in phishing scams too – a highly visible warning screen will appear. You can bypass this, but don't

Web browsers such as Firefox have built-in controls to help protect you against malware-infected downloads.

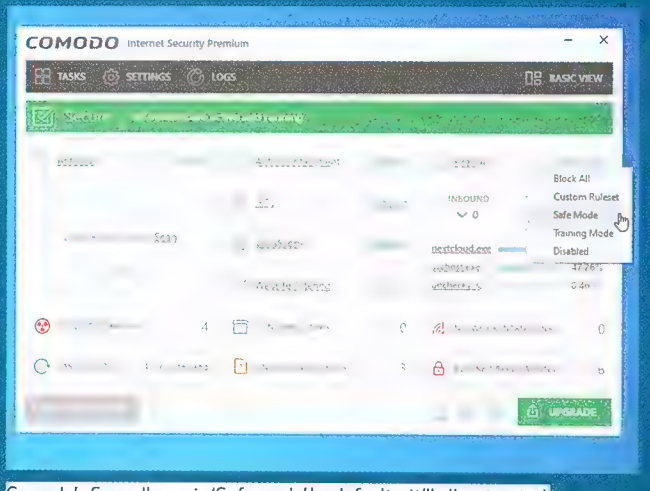


Windows SmartScreen usually throws up a blue dialog for unknown apps, and red for viruses.

» CONFIGURE YOUR FIREWALL

While Windows Security performs well against malware, there's one weak link – its firewall. The Windows Firewall is configured only to monitor incoming connections – in other words, those made to your PC over your network or the internet. It assumes all traffic originating from your PC is legitimate – but this can include any malware that's sneaked through your defences and has established a backdoor connection to the internet. These can then dial home to begin wreaking whatever havoc they've been designed to inflict.

This step-by-step guide reveals how to add two-way protection to Windows Firewall using a free add-on package from Malwarebytes, but if you want a more user-friendly alternative then reputable Internet Security packages from the likes of Norton, Kaspersky and Bitdefender all ship with two-way firewalls. A no-cost option is Comodo Internet Security Free. Its firewall works in a similar way to WFC while offering additional functionality such as being able to run your web browser inside a 'sandbox' (isolated container) to protect the rest of your system. See **www.comodo.com/home/internet-security/free-internet-security.php** for details.



Comodo's firewall runs in 'Safe mode' by default – it'll allow trusted apps to access the internet, only alerting you to unknown ones.

say you haven't been warned if you decide to ignore its assessment.

THIRD-PARTY PROTECTION

If you're looking to add extra layers of protection to your PC, there are numerous free and paid-for third-party packages out there. If you're in the market for third-party protection or want to review your current package as its subscription comes up for renewal, visit **www.av-test.org/en/antivirus/home-windows/** for a comprehensive list of tests, updated regularly. What you'll notice, though, is that Windows Security now rates highly in malware detection and cleaning tests.

Does this mean there's no need for additional protection? Windows Security provides a good last line of defence, but third-party tools tend to offer a wider range of preventative measures – and if you're still running Windows 7 or 8.1, then switching to a different security package is essential. You should also look to strengthen – if not replace – the built-in Windows Firewall. See below for why, and how.

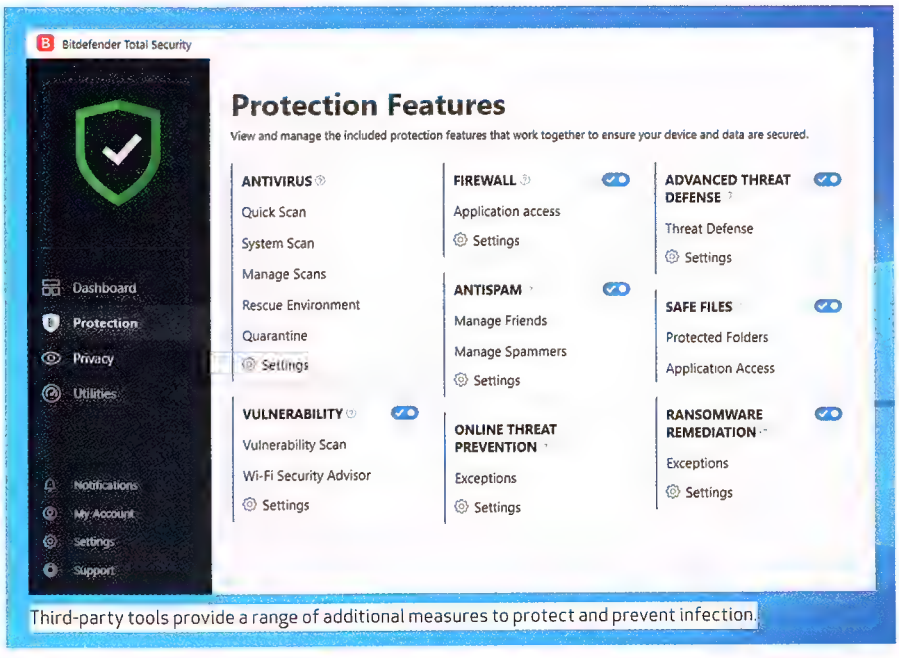
ADD EXTRA LAYERS

In addition to a firewall, third-party tools provide additional components to help close more gaps in your protection. They'll often proactively scan USB drives when plugged into your PC, and some offer protection for smart devices like webcams too, ensuring they can't be switched on surreptitiously by hackers for spying purposes. Parental controls allow you to protect younger members from more threats than the basic options provided in Windows itself.

Take Bitdefender for example: it comes with an online threat prevention module, which works proactively in the background to protect you when browsing the web or using your network. Built-in anti-ransomware protection is augmented by its Safe Files component, which allows you to specify protected folders such as Documents and so on. When enabled, applications can't access these folders without you explicitly granting them permission, serving as an extra block against ransomware.

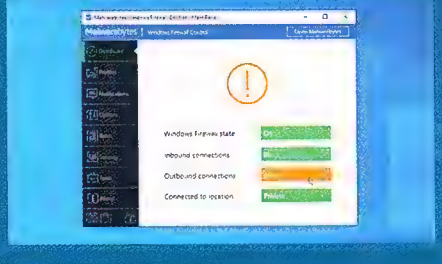
Many security tools also provide tools that scan for security vulnerabilities – not just in Windows, but your applications and Wi-Fi network too. They'll alert you to weak passwords, outdated programs and missing Windows security fixes.

Whether or not you opt for third-party protection, we strongly recommend you install a secondary, non-conflicting package to provide another layer of security. Our go-to package remains Malwarebytes Anti-Malware – its detection rates have suffered of late as a primary package, but as backup protection it remains second-to-none. Download the free version from **www.malwarebytes.com** – there's a 14-day free trial offering proactive, real-time protection against malicious websites, PUPs and other threats not covered by some security packages, then revert to a scan-and-remove tool if you don't want to pay the $59.99/year asking price.

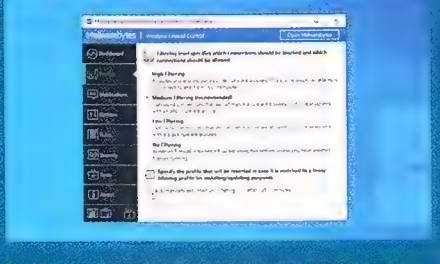


Third-party tools provide a range of additional measures to protect and prevent infection.

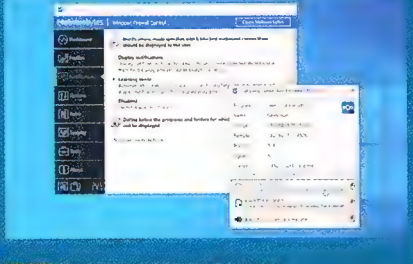
UPGRADE THE WINDOWS FIREWALL



1 INITIAL STEPS
Download and install Windows Firewall Control from **www.binisoft.org/wfc** – once installed, type 'wfc' into the Search box to launch Malwabytes Windows Firewall Control. The original status screen will reveal it's currently set to Windows Firewall defaults, allowing all outbound connections.



2 SWITCH THE PROFILE SETTINGS
To start monitoring outbound connections, switch to the Profiles section and select 'Medium filtering (recommended)'. Also tick the failsafe 'Automatically set' box. Now switch to Notifications and select 'Learning mode' to switch monitoring on.



3 REVIEW AND ALLOW
All digitally signed and trusted apps will be given network access automatically, but you'll start to see pop-up notifications for other apps. If they're trusted (not all safe apps are signed), click 'Allow this program'. If you're not sure, press 'Block for now and ask me later.

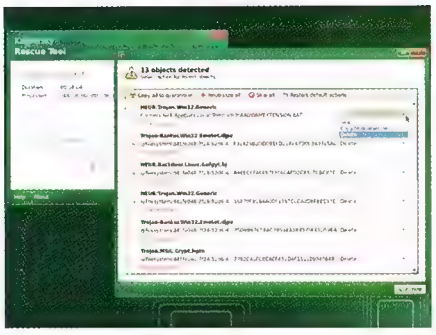
Remove malware from your PC

Discover what to do when malware strikes – find out how to remove it, plus clean up afterward.

When your security protection works as it should, you'll either enjoy a hassle-free life or see the occasional alert pop up when your antivirus tool spots – and blocks – a potential infection from taking hold. But if your security regimen is compromised, you'll have to take remedial steps to clear any infection from your machine – sudden sluggish performance, random popup alerts and other strange behaviour might all point to infection.

The simplest thing to do is try and run a scan with your existing security tools having first attempted to install the latest updates – if they detect the threat, let them attempt to clean or quarantine it, then reboot and run full scans again. If infections keep cropping up, or you're unable to open your security tool, you may need to attempt to boot into Safe mode to run your security software from where the malware can't cripple it.

Most anti-virus vendors provide standalone removal tools – try a selection if you're struggling.



Kaspersky's rescue disc – like others – loads a virtual desktop to run its own removal tools.

SCANNING FROM SAFE MODE

There are two ways to enter Safe mode – one method is described opposite in the step-by-step guide. If that takes you back to the normal desktop, try pressing Win-R, typing msconfig and pressing Enter. Switch to the Boot tab, tick 'Safe boot' and select Network before clicking OK and rebooting when prompted.

Some malware removes the Registry keys required to successfully boot into Safe mode – if you're unable to get Safe mode to work following the steps in the guide opposite, skip to the next section. For those who can get into Safe mode, you'll need to enter your user password (any PINs aren't accessible from here) to log in. At the desktop, open your existing security packages, let them update and run full scans.

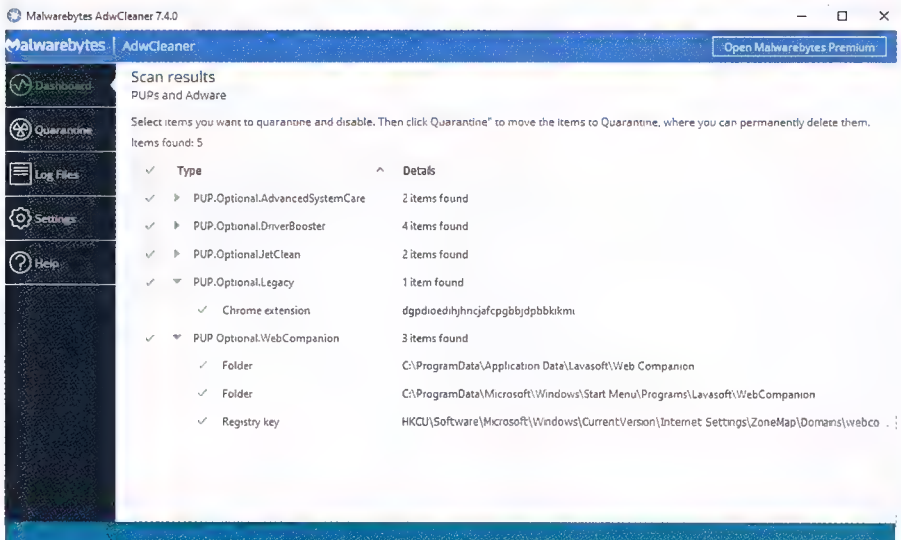
Hopefully they'll find and remove the infection, in which case reboot back into normal mode (if you used msconfig to get into Safe mode, you'll need to open it again and untick 'Safe boot' before clicking OK and rebooting) and run final scans to verify the infection has gone.

If you want to be doubly sure the infection has been removed – or your security software doesn't find anything, try enlisting the help of several additional tools. Most security vendors offer free scan-and-removal tools, so Google 'virus removal tools' to see what's available. One example worth trying – because it employs the services of two separate anti-virus engines – is Emsisoft Emergency Kit (EEK), which you can download and run from **www.emsisoft.com/en/software/eek/** for second and third opinions. Also try VIPRE Rescue (**www.vipreantivirus.com/vipre-rescue-virus-removal-tool.aspx**) if EEK doesn't work.

USE BOOTABLE RESCUE DISCS

If you're locked out of Safe mode and have access to another, clean PC, visit your antivirus vendor's website on there to track down a bootable emergency rescue disc. If it doesn't offer one, download the Kaspersky Rescue Disc ISO from **https://support.kaspersky.com/viruses/rescuedisk** to a clean PC. Either right-click the ISO and choose 'Burn image' to burn it to CD or DVD, or use a tool like Rufus (**https://rufus.akeo.ie/**) to create a bootable USB drive.

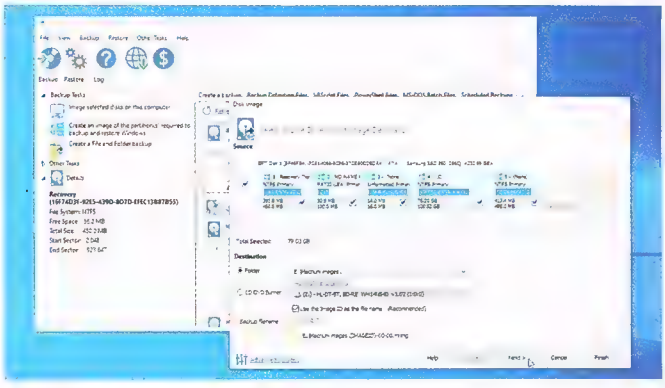
After booting, a separate desktop environment is loaded and the Kaspersky Rescue Tool will automatically start. Let it scan – multiple times if prompted – to ensure all traces of the infection are removed.



» BEAT BROWSER HIJACKS

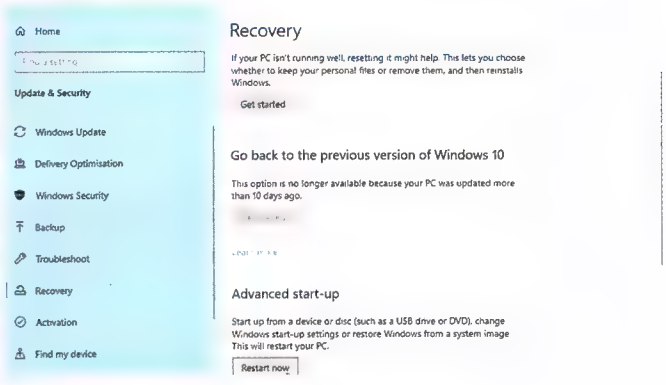
If your browser's home page has been changed, or unwanted toolbars and popups appear, you're the victim of a browser hijack. Try Malwarebytes' AdwCleaner from **www.malwarebytes.com/adwcleaner** (scroll down to the green 'Free Download' button). Close all browsers and launch the tool, granting it admin access when prompted, then click Scan Now. Finally, review its findings and quarantine anything you don't like the look of.

Clean up after a **malware infection**



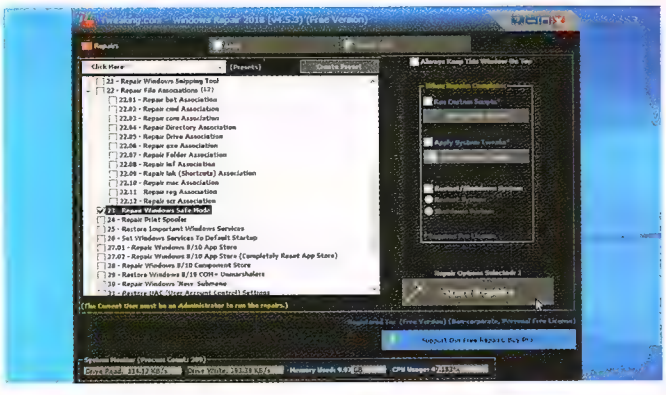
1 TAKE A FAIL-SAFE BACKUP

Repairing Windows can lead to unforeseen consequences. Start by creating a full drive image using your back-up tool – Macrium Reflect Free (**www.macrium.com/reflectfree.aspx**) is our go-to tool. Make sure you've also created emergency rescue media – just in case.


Home
Update & Security
Windows Update
Delivery Optimisation
Windows Security
Backup
Troubleshoot
Recovery
Activation
Find my device
Recovery
If your PC isn't running well, resetting it might help. This lets you choose whether to keep your personal files or remove them, and then reinstalls Windows.
Get started
Go back to the previous version of Windows 10
This option is no longer available because your PC was updated more than 10 days ago.
Advanced start-up
Start up from a device or disc (such as a USB drive or DVD), change Windows start-up settings or restore Windows from a system image. This will restart your PC.
Restart now

2 REBOOT INTO SAFE MODE

Click Start > Settings > Update & Security > Recovery and click 'Restart now' under 'Advanced start-up'. Choose Troubleshoot > Advanced options > Start-up Settings to select Safe mode (we recommend the 'Safe Mode with Networking' option to retain internet access).

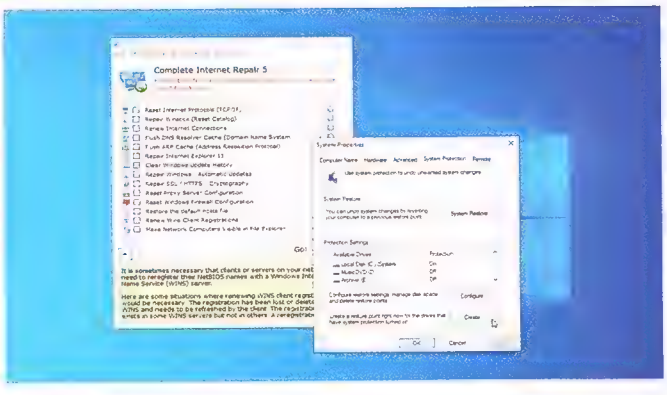


3 FIX SAFE MODE

If Safe mode won't work, reboot or restore your backup if your PC no longer boots. Install and run Windows Repair (**www.tweaking.com**), switch to the 'Repairs – Main' tab, click 'Open Repairs'. Untick 'All Repairs', then choose '23 – Repair Windows Safe Mode' and click Start Repairs. Try Safe mode again.

4 REPAIR FROM SAFE MODE

If not already installed, download and run the portable version of Windows Repair. Choose 'Preset: Malware Cleanup Repairs' from the 'Repairs – Main' tab to select repairs linked to malware infections. Click 'Start Repairs' to hopefully fix the worst of the damage. Reboot into normal mode.



5 FIX INTERNET PROBLEMS

If you're unable to access the internet or network after cleaning up after malware try the repairs offered in one or both of Complete Internet Repair 5 (**www.rizonesoft.com/downloads/complete-internet-repair/**) and NetAdapter Repair All In One (**https://sourceforge.net/projects/netadapter/**).

6 DECRYPT RANSOMWARE

If files have been left encrypted and you have no backups to call on, make a note of the ransomware type from your security logs and visit **www.nomoreransom.org** – upload two of your encrypted files and paste in the ransom note to detect its type and hopefully locate a free decryption tool.

Expand your protection

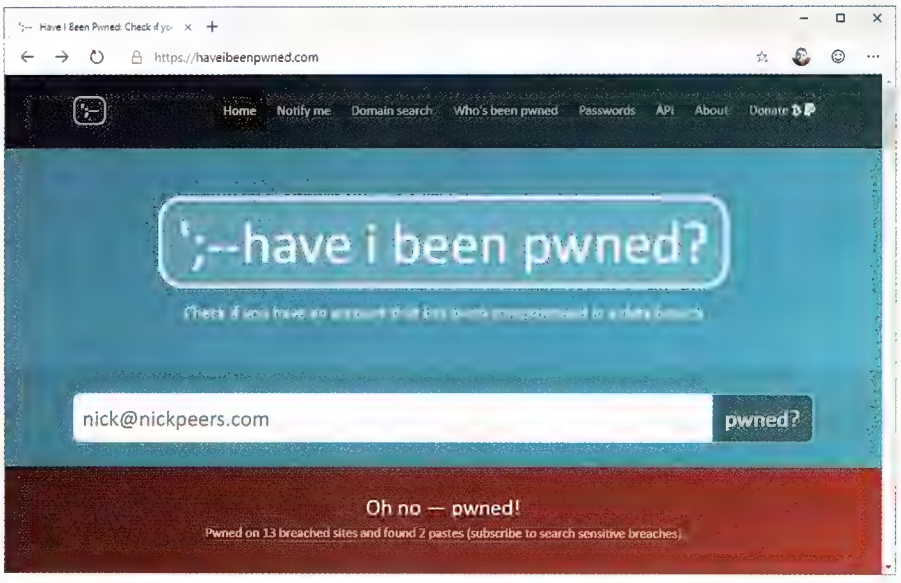
Fill in the gaps in your security and privacy with this essential collection of tips, techniques and tools.

You've got the essentials sorted – anti-malware software in place, plus any tools you've downloaded from the previous spread on cleaning malware infections (even if your PC is currently behaving itself, now is a good time to collect them together somewhere safe, like on a USB flash drive). Now you've locked down your PC, what other steps can you take to secure other parts of your online life?

SECURE ONLINE ACCOUNTS

Browse to **www.haveibeenpwned.com** where you're almost certain to discover your trusted passwords of old have been involved in at least one security breach – even if you weren't personally affected, common passwords like 'fred1234' are bound to have been used by others and subsequently exposed too. We recommend installing a strong password manager like BitWarden (**www.bitwarden.com**) to store and generate new lengthy, randomly generated passwords comprising letters, numbers and special characters. All you need to remember going forward is one master password – make sure that password is both memorable and long, not easily guessed and a mix of letters and numbers.

Add an extra layer of protection to your BitWarden password vault – and other key online accounts – by adding two-factor authentication (2FA) to your login. This prevents anyone from getting into your account without physical access to your phone – even if your password is compromised. 2FA codes can be delivered by email, mobile text or to an authenticator app – email isn't secure (see below), while text messages require you to have a mobile signal when sent. The best option is the authenticator app – we currently recommend Authy (**https://authy.com/**), which can be installed on more than one device (including your PC) and codes accessed even when offline.



Don't panic if you find your email address appears in various site breaches – just make sure your passwords have been changed.

SECURE INTERNET ACCESS

Virtual Private Networks (VPNs) serve two major purposes: one, they encrypt your internet traffic on insecure networks such as public Wi-Fi hotspots, but they also mask that traffic from your Internet service provider too. By

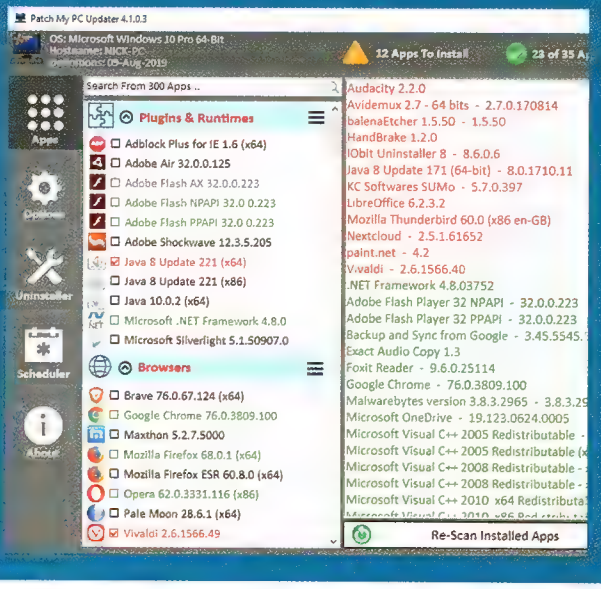
» FILL IN THE GAPS

Windows Security has plenty of built-in protection against system exploits, rootkits and the like, but there are still gaps – many behavioural related – that you can close with the help of free software. Start by keeping an eye on programs that need software patches with the help of Patch My PC (**https://patchmypc.com/home-updater-overview**).

Add protection against PUPs with Unchecky (www.unchecky.com), while IObit Uninstaller (**www.iobit.com/en/advanceduninstaller.php**) has a Bundleware section that can help root out PUPs already on your system. Worried about the security of sensitive data backed up to the cloud? Ensure your files are protected by an extra layer of encryption before being uploaded with Cryptomator (**https://cryptomator.org/**).

Add extra protection against potentially harmful websites by adding traffic-light security ratings to web pages and search engine results using one of Norton's Safe Web (Chrome, Firefox and Edge) or BitDefender Traffic Light (Chrome and Firefox). Search your browser's add-on store for the appropriate plugin.

Finally, want to screen email before downloading it? Install PopTrayU (**http://poptrayu.sourceforge.net/**) or POP Peeper (**www.esumsoft.com**) to preview all of your accounts from one convenient app.


Patch My PC Updater 4.1.0.3
12 Apps To Install
Search From 300 Apps ..
Plugins & Runtimes
Adblock Plus for IE 1.6 (x64)
Adobe Air 32.0.0.125
Adobe Flash AX 32.0.0.223
Adobe Flash NPAPI 32.0.0.223
Adobe Flash PPAPI 32.0.0.223
Adobe Shockwave 12.3.5.205
Java 8 Update 221 (x64)
Java 8 Update 221 (x86)
Java 10.0.2 (x64)
Microsoft .NET Framework 4.8.0
Microsoft Silverlight 5.1.50907.0
Browsers
Brave 76.0.67.124 (x64)
Google Chrome 76.0.3809.100
Maxthon 5.2.7.5000
Mozilla Firefox 68.0.1 (x64)
Mozilla Firefox ESR 60.8.0 (x64)
Opera 62.0.3331.116 (x86)
Pale Moon 28.6.1 (x64)
Vivaldi 2.6.1566.49
Audacity 2.2.0
Avidemux 2.7 - 64 bits - 2.7.0.170814
balenaEtcher 1.5.50 - 1.5.50
HandBrake 1.2.0
IObit Uninstaller 8 - 8.6.0.6
Java 8 Update 171 (64-bit) - 8.0.1710.11
KC Softwares SUMo - 5.7.0.397
LibreOffice 6.2.3.2
Mozilla Thunderbird 60.0 (x86 en-GB)
Nextcloud - 2.5.1.61652
paint.net - 4.2
Vivaldi - 2.6.1566.40
.NET Framework 4.8.03752
Adobe Flash Player 32 NPAPI - 32.0.0.223
Adobe Flash Player 32 PPAPI - 32.0.0.223
Backup and Sync from Google - 3.45.5545.
Exact Audio Copy 1.3
Foxit Reader - 9.6.0.25114
Google Chrome - 76.0.3809.100
Malwarebytes version 3.8.3.2965 - 3.8.3.2
Microsoft OneDrive - 19.123.0624.0005
Microsoft Visual C++ 2005 Redistributable
Microsoft Visual C++ 2005 Redistributable
Microsoft Visual C++ 2008 Redistributable
Microsoft Visual C++ 2008 Redistributable
Microsoft Visual C++ 2010 x64 Redistributa
Re-Scan Installed Apps

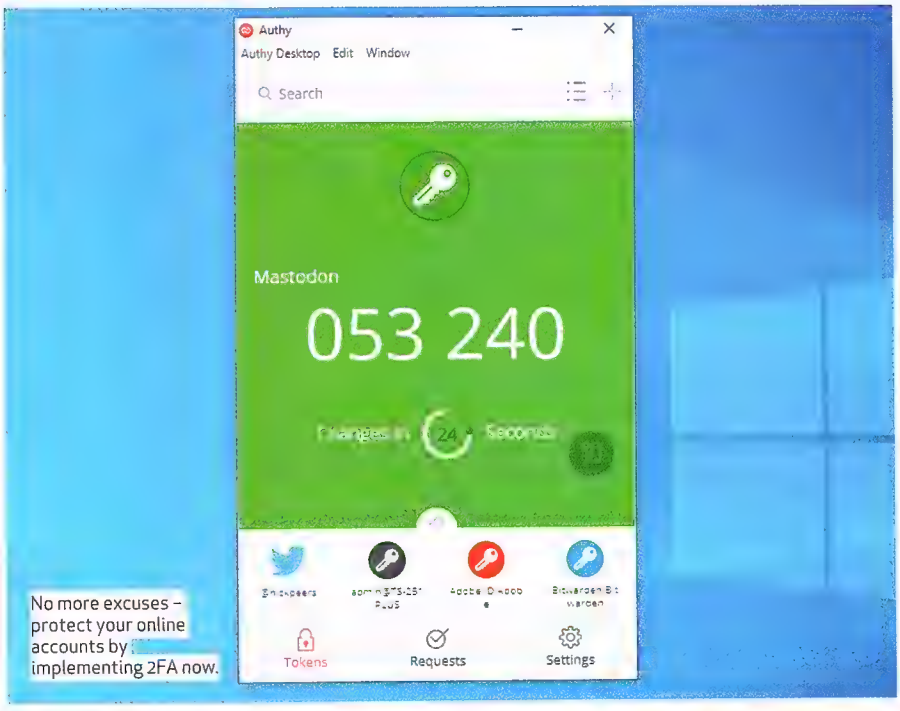
connecting to a VPN server in a different country you're also able to trick internet services as to your actual location, enabling you to bypass many geographic restrictions – for example, enabling you to access catch-up TV while abroad on holiday.

While VPNs encrypt your data in transit, they don't hide it from the services you're connecting to, so you'll need to continue to take steps to protect your web browser. Make use of private or incognito windows when browsing – which allegedly don't store any tracking information after they've been closed. We say allegedly – it's still possible for your traffic to be monitored by your internet service provider.

One way to tighten this security is by enabling so-called DNS over HTTPS if your browser allows you to do – for example, Firefox users should open Options > General tab, then scroll all the way down and click Settings under 'Network Settings' before ticking 'Enable DNS over HTTPS' (with the default Cloudflare provider) before clicking OK. This prevents man-in-the-middle attacks and eavesdropping on the websites you visit.

Also look to install add-ons to help block trackers and malicious advertising. The step-by-step below reveals how to use Disconnect to monitor and block invisible trackers – after installing it, install AdBlock Plus (**https://adblockplus.org/**) for a sensible approach to blocking intrusive and potentially dangerous adverts without removing all adverts.

Email is notoriously insecure – unencrypted and easy to intercept. Traditional encryption techniques involving PGP only work with contacts who apply it to their own email. One workaround is to sign up for a free



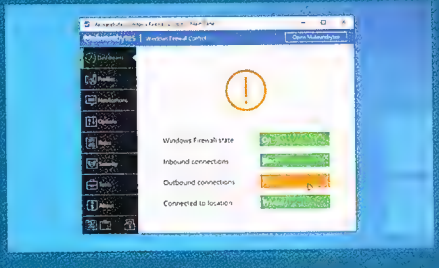
No more excuses – protect your online accounts by implementing 2FA now.

"Two-factor authorisation stops anyone getting into your account without access to your phone."

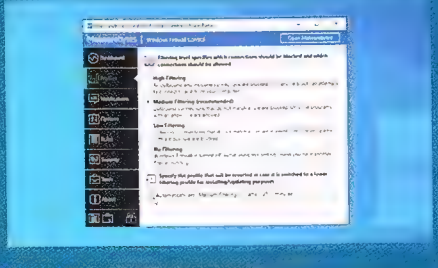
ProtonMail account (**www.protonmail.com**). Mail between ProtonMail users is automatically encrypted, while you can configure sensitive messages so non-ProtonMail users are directed to a secure, encrypted web link to read – and reply – to the message.

Protecting yourself when chatting with others and using social media is a must too. Install the Facebook Container add-on for Firefox, for example, and you can isolate Facebook from the rest of your web activity by forcing it to run in a sandbox – that way it can't spy on you through tracking cookies. Similarly consider switching from well-known, but not necessarily secure, technologies such as Skype and WhatsApp to Signal (**https://signal.org**), an open-source chat tool that works on your phone and PC desktop and offers secure end-to-end encryption.

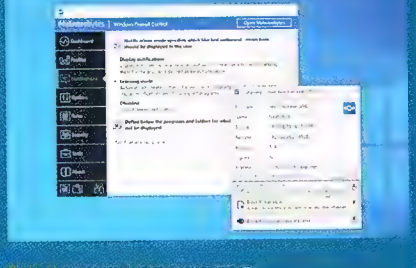
» TRACK THE TRACKERS



1 INSTALL DISCONNECT
Go to **https://disconnect.me/** disconnect and click 'Get Disconnect' to locate the plugin in your browser's add-on store, then install it from there. Once installed, you'll see the Disconnect button appear in your browser toolbar. You do not need to donate if you don't want to



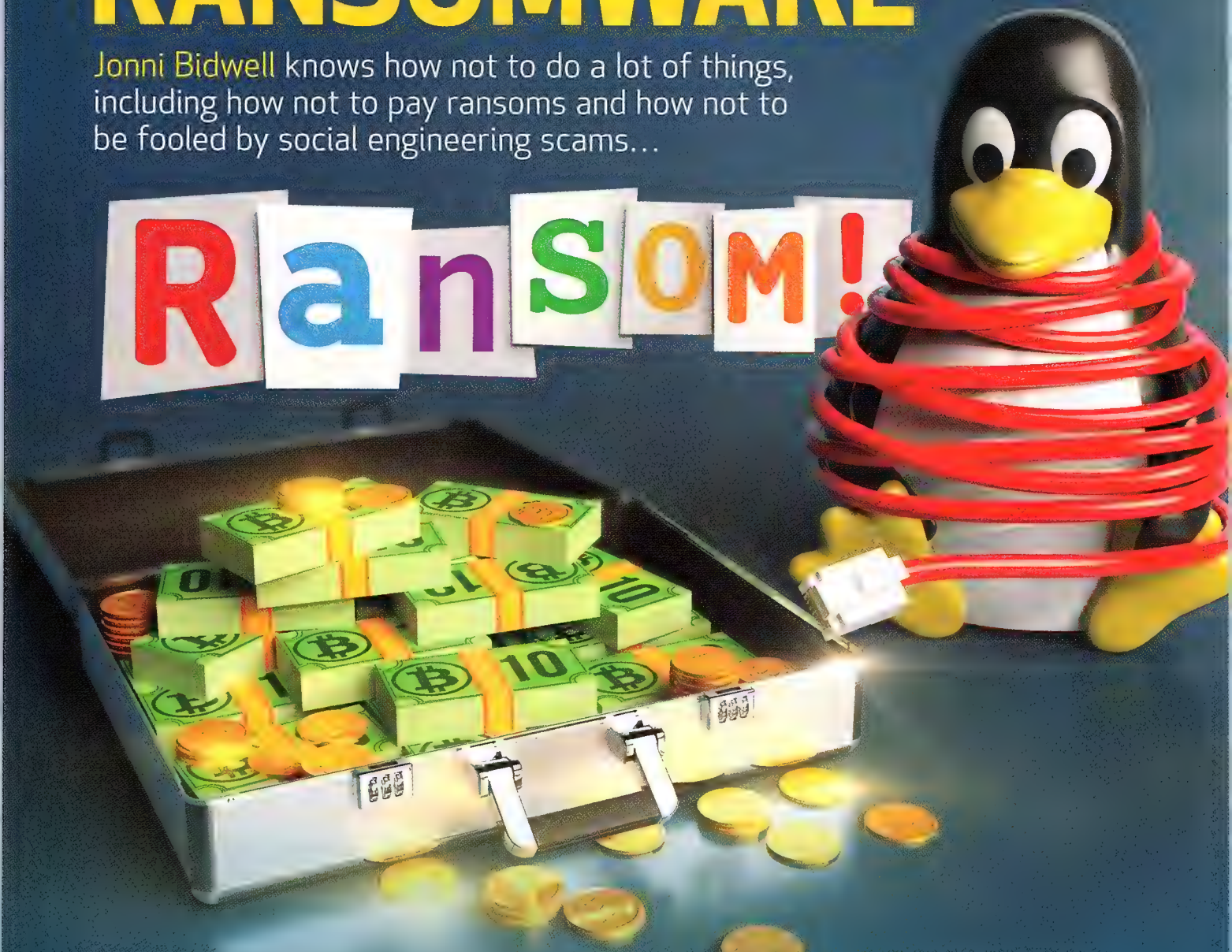
2 MONITOR WEBSITE
Now browse to one of your favourite websites. You'll see the Disconnect button display a number – this is the number of trackers it has detected. Click the Disconnect button for a summary, split into four sections – click one to reveal the specific requests made.



3 BLOCK TRACKERS
Any trackers ticked and marked green are blocked by default; grey trackers are safer, but can also be blocked by ticking the box. You'll see statistics revealing how much time is saved not processing the trackers. Click the 'Visualize page' button to see where the trackers go.

BLOCK LINUX RANSOMWARE

Jonni Bidwell knows how not to do a lot of things, including how not to pay ransoms and how not to be fooled by social engineering scams...



Many of us are still patiently waiting for the year of the Linux desktop, but one sign that Linux has become mainstream is that it is now actively targeted by malware pushers. Perhaps not to the same extent as Windows, and perhaps those miscreants are more interested in hijacking servers than desktops, but peddling the old "Linux doesn't get viruses" line does not make for credible journalism.

Linux servers are compromised all the time. It's a little too easy for your run-of-the-mill script kiddie to find their favourite exploit in Metasploit, find some vulnerable servers via **shodan.io** and create havoc. Attacking desktop Linux is a little more delicate, but that's not to say it doesn't happen. Rogue websites may serve drive-by downloads, bona fide websites may get hacked or a long-standing bug in the kernel may be discovered. All of which might spell the end for your data.

A much greater threat, however, is social engineering. This is pretty much operating system agnostic – it relies on weaknesses in human nature rather than in software – so there'll be a few tips that will help you even if you use some other heathen OS. A well-crafted email can trick a weary mark into opening the wrong kind of file, disclosing their password (or other personal information) or even wiring money to a stranger. Some of these scams are easy to spot, but others are not. Over the last five years, cyber-criminals (we promise not to use this prefix too much) have cottoned on to the fact that people care about their files, so a popular MO is to encrypt them and hold them to ransom. Victims are 'invited' to pay, usually by cryptocurrency, for a decryption key, but often this is never provided. Sometimes ransomware is ill thought-out, and boffins can reverse-engineer whatever encryption was used and provide free decryption tools. But you shouldn't count on this. Instead heed our guide – be strong, be vigilant and behave.

Ransom and deceit

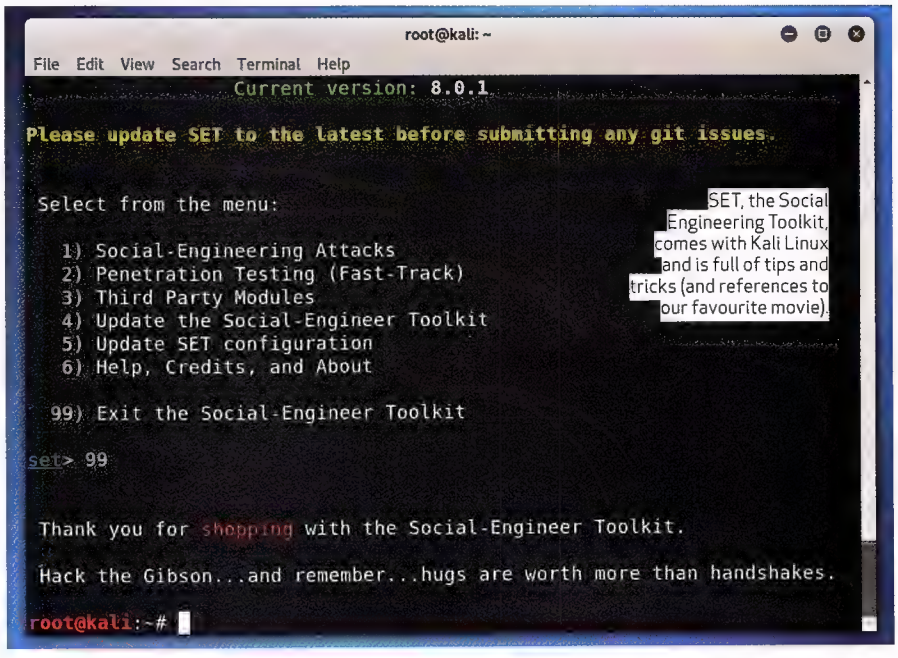
The scammers have figured out that your data is more valuable to you than it is to others. Don't let them exploit this fact.

Holding things to ransom is an ancient idea, and one that has been shown to work very well. Kings, nobles and precious works of art have been ransomed since antiquity. Likewise using smooth talking to hoodwink people into doing things they probably shouldn't – grifting, if you will. But in the digital age these practices take on a whole new, sinister dimension. On the face of it having files held to ransom is in an entirely different league to having a family member kidnapped. But what if people's lives depended on the integrity of those files? Terrifyingly enough, this has happened on more than one occasion.

The Wannacry ransomware outbreak of 2017 infected some 300,000 computers in 150 countries –making it, according to veteran security researcher Mikko Hypponen, "the biggest ransomware outbreak in history". People showing up to work were greeted by their computers asking for Bitcoin payments equivalent to $300-$600 to decrypt their files. In the UK it famously brought the NHS to its knees. Patients saw operations cancelled, and were advised to only seek medical care in emergencies. Staff, devoid of network and phone access, had to resort to manual methods to deliver vital healthcare services.

Commentators were quick to point out that the NHS had, and still has, a number of machines running Windows XP, but these weren't really the problem –most of these were embedded installations that can't be upgraded and weren't even connected to the network. The problem was the huge number of unpatched Windows 7/8/2000 systems that were vulnerable to a bug in the SMB protocol of which, it turns out, the NSA was aware for some time. It had in fact weaponised said bug for use in its own Tailored Access Operations unit, and named the exploit EternalBlue.

Unfortunately that exploit fell into the hands of a hacker collective known as the Shadow Brokers. The NSA alerted Microsoft to the possible theft and a patch was issued in March 2017. In April 2017, EternalBlue – alongside other NSA exploits named EternalChampion and EternalRomance – was leaked by the Shadow Brokers and a month later, when many systems remained unpatched, WannaCry used it to wreak havoc around the world.


root@kali: ~
File Edit View Search Terminal Help
Current version: 8.0.1
Please update SET to the latest before submitting any git issues.
Select from the menu:
1) Social-Engineering Attacks
2) Penetration Testing (Fast-Track)
3) Third Party Modules
4) Update the Social-Engineer Toolkit
5) Update SET configuration
6) Help, Credits, and About
99) Exit the Social-Engineer Toolkit
set> 99
Thank you for shopping with the Social-Engineer Toolkit.
Hack the Gibson...and remember...hugs are worth more than handshakes.
root@kali:~#

SET, the Social Engineering Toolkit, comes with Kali Linux and is full of tips and tricks (and references to our favourite movie).

We'd love to say there are magical open source tools that with just a little bit of command-line fu can help you recover from any ransomware attack, but that's just not the case. And nor will it ever be. There are a couple of things that are guaranteed to help you though, and they're skills everyone should practise.

The best solution to all of these woes is something you should already be doing: regular backups.

» PAY UP OR THE DATA GETS IT

A number of high-profile organisations have paid ransom fees, and we are likely to see a lot more of this unless our collective security game is upped.

Large organisations with lax security practices can (but shouldn't) be crippled by a careless employee falling for an email scam. This may be an untargeted attack, where the ransomware keymasters' expected targets are unsuspecting home users, in which case the asking price is pretty modest.

Or it could be some kind of spear phishing campaign, where execs or sysadmins are targeted so their privileges or well-endowed bank accounts can be ransacked. And if you're going to cripple a large organisation you'll probably be after more than pocket change.

In June of this year, Riviera Beach City Council in Florida agreed to pay a US$600,000 ransom to hackers after their systems were crippled. They join a growing number of institutions that have chosen to cough up six-figure sums in order to restore critical services. A 2018 report from SentinalOne surveyed some 500 large organisations and found that of those hit by ransomware, 45 per cent of them had paid up, but only 26 per cent of those had their files unlocked. So much for honour among thieves.

Backup your files

They say there are two kinds of people in this world: people who don't backup their files, and people who have never experienced data loss.

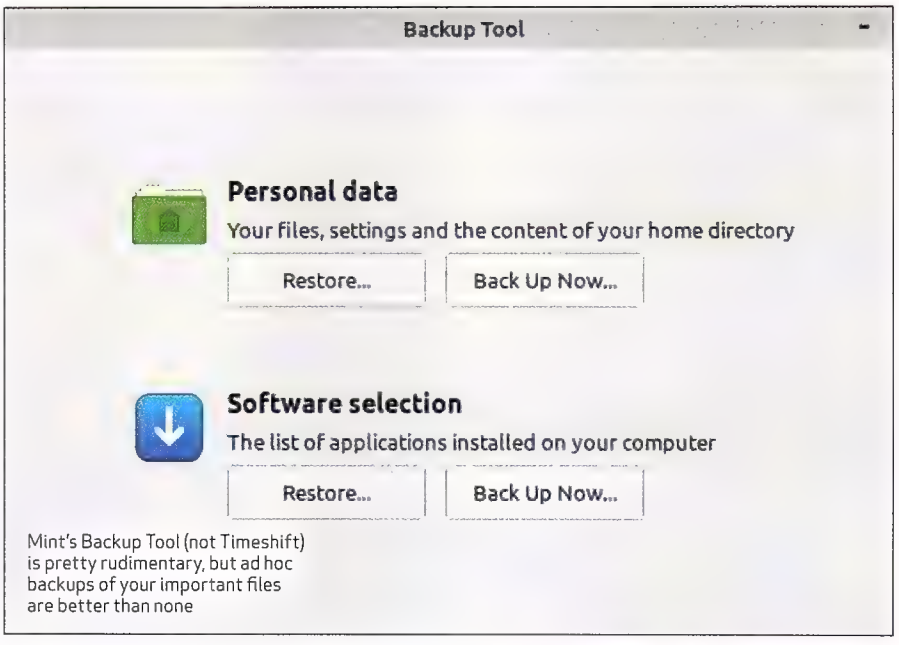
There's no shortage of backup tools available for Linux. Timeshift is great for backing up system files. It's vaguely analogous to System Restore in Windows or Time Machine on macOS and it comes as standard with Linux Mint. For backing up personal files we recommend DéjàDup (**https://wiki.gnome.org/Apps/DejaDup**) – it has a simple GUI and can automate everything for you. In its own words "It hides the complexity of doing backups the Right Way (encrypted, off-site, and regular)". It also comes by default with Ubuntu, so check out our handy six-step guide to using it, opposite.

Behind the scenes DéjàDup uses the Duplicity command line tool, so if you prefer to do things old-school you can hack up some scripts, cron jobs and what have you to invoke this directly. All the magic (incremental backups, encryption, scheduling) happens in Duplicity, so if your command line and scripting mojo is strong this might be the option for you. It's great for server-type things where you don't necessarily have the luxury of a GUI.

For typical home use your personal files are, we think, much more important than the rest of the system. Whatever flavour of Linux you have, if your system gets hosed you can re-install it and all the applications in a matter of between minutes (Ubuntu) and days (Arch). Fair enough, it might take longer to replicate all the little tweaks that you've added along the way, and maybe it'll never end up quite the same. Your photos and documents and movies are far more precious.

You may, and should, already back up some of these to some kind of cloud storage, be it an open source offering like Nextcloud (yay!) or a proprietary one such as Dropbox (meh). The trouble with clients like these – ones that automatically keep your local files and cloudy files synchronised – is that in the midst of a ransomware attack they will happily send scrambled files to the cloud. So instead of having an off-site backup you effectively have an off-site rubbish dump.

This all depends on the nature of the ransomware –perhaps it changes filenames, or perhaps the malware interferes with the client and prevents the sync from happening, in which case you would be okay. Still, why take the risk? Use a proper backup tool, and backup to an external hard drive that isn't always connected: cold storage, if you like.



Mint's Backup Tool (not Timeshift) is pretty rudimentary, but ad hoc backups of your important files are better than none

KEEPING REGULAR

Backing-up for the first time might give you some sense of security, and rightly so. But backing-up should be a way of life, not a one-off event or even something you do on an ad hóc basis. Unless you integrate it into your digital routine then you're risking all your latest and greatest work (or fresh memes). Fortunately, thanks to modern tooling this is easier than ever.

Of course, life will be much easier if your files are in some kind of ordered state, but we can't all be Melvil Dewey. Your first backup may take a long time, depending on how much stuff you have so pop the kettle on. Or you may have to cancel it when you realise certain directories should have been included or excluded. But once it's done, you're happy with it and don't go messing up your document structure too much, subsequent backups will be much easier. Later backups will probably be much quicker, since they are done incrementally – only files that have changed since the last backup will be stored.

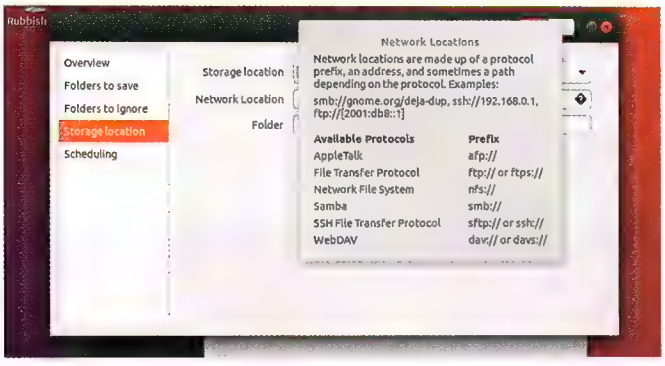
We like KeePassXC, and we also like when our readers use it and perform regular backups.

If you're using Mint you may prefer to use its own Backup Tool which is simple to use but doesn't have the scheduling facilities. It's great for casual backing-up of your home directory, but doesn't have all the scheduling and other features of DéjàDup. You can install it on Mint and other Debian-like systems (you already have it if you're using Ubuntu) with:

```
$ sudo apt install deja-dup
```

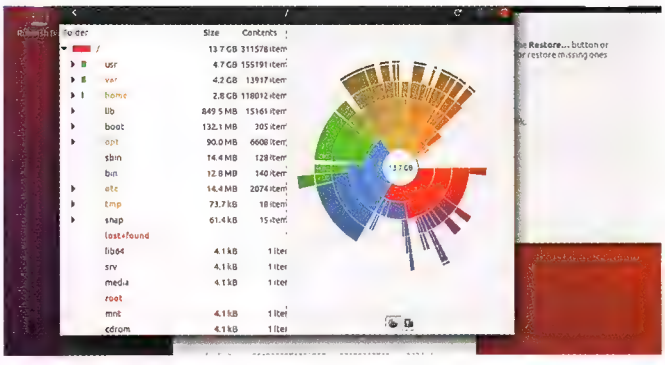
Then fire it up and follow this handy guide to securing your precious files.

Backup with DéjàDup



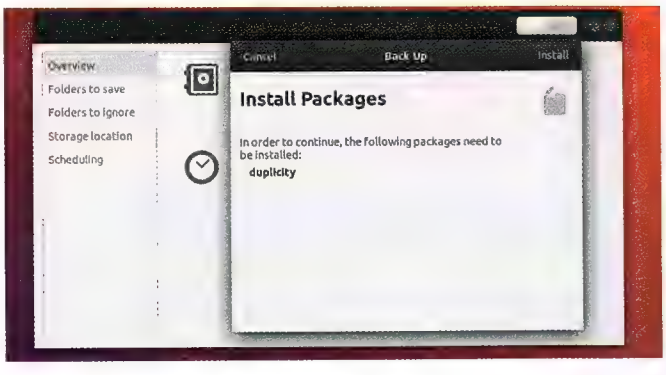
1 SET BACKUP LOCATION

You can use Gnome's online accounts feature to back up to Google Drive, a Nextcloud instance and more. You can also use a network location such as Samba or SSH, or a local folder. We recommend using an external hard drive and unplugging it afterwards. If you use a truly local folder, be aware that anywhere you can write to could be hit by a ransomware attack.



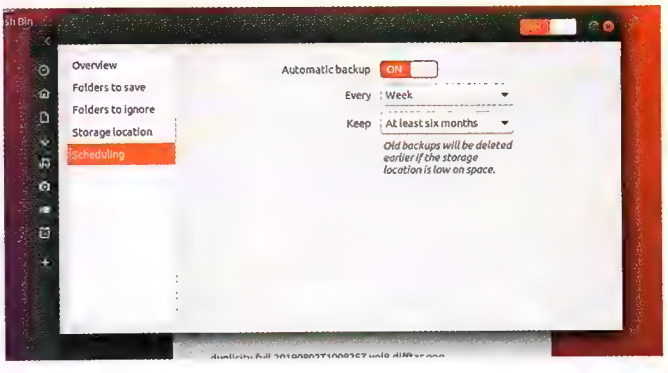
2 CHOOSE WHAT TO SAVE

Add any folders outside your home directory you want to include in the backup, and exclude any inside that you don't. The ~/.cache/ folder is not necessary and often takes up lots of space – it's where Chromium's cache is stored. If you use Steam then you'll want to exclude ~/.steam as well. Gnome's Disk Usage Analyzer is a useful tool to see what's taking up space.



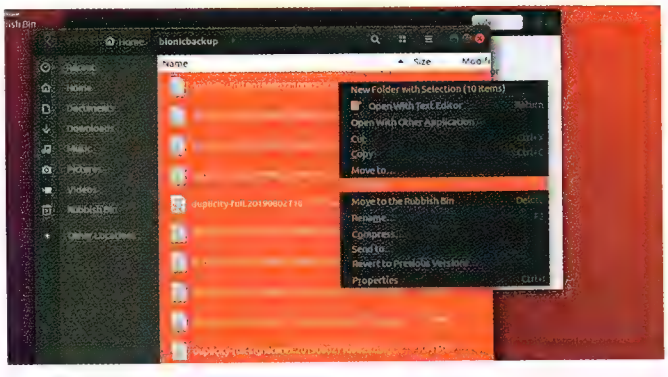
3 INITIATE THE BACKUP

Hit the Back Up Now button. You may be prompted to install Duplicity and you will be prompted for a password. If you use one (encrypting off-site backups is a good idea) then for pity's sake don't forget it; in fact, just use a password manager, like we tell you to later in this feature. Click the Forward button and start to feel secure in the knowledge that your files are safe.



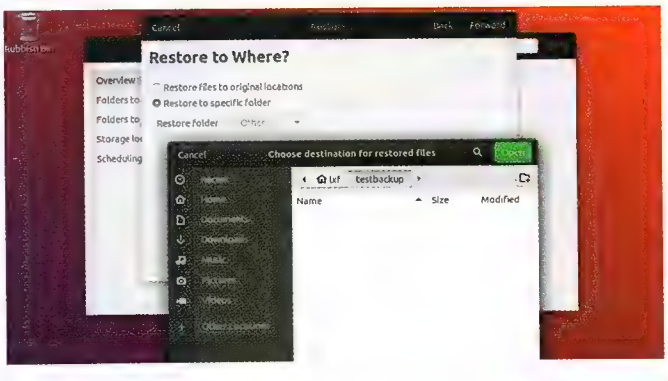
4 SET UP A SCHEDULE

Just as with yoga, regular practice is the key to backup heaven. Click the Scheduling tab to choose the frequency and longevity of backups. If you backed up to a location that isn't available when an automatic backup initiates, don't worry, you'll be warned. Also beware of running out of space – old backups will be silently removed in this event, which may not be ideal.



5 BE SURE TO BE SURE

This step is optional, but a belt-and-braces approach is always good if you truly care about your data. So consider manually copying your encrypted backups somewhere else: a USB key, your home server, somewhere in the cloud, it doesn't matter. Redundancy is good and since you encrypted your backups (didn't you?), losing the storage shouldn't be a concern.



6 TEST YOUR BACKUPS

Making backups is all very well, but you need to be sure they are viable and that you know the drill for restoring them. Click the Restore button, plug in your storage device if that's how you did it, choose your backup location and choose the date to restore from. The most recent is shown first. For this test, restore to a specific folder so nothing is overwritten.

Anatomy of a **ransomware attack**

Ever wondered how all this high-tech financial half-inching and data scrambling works? Wonder no more.

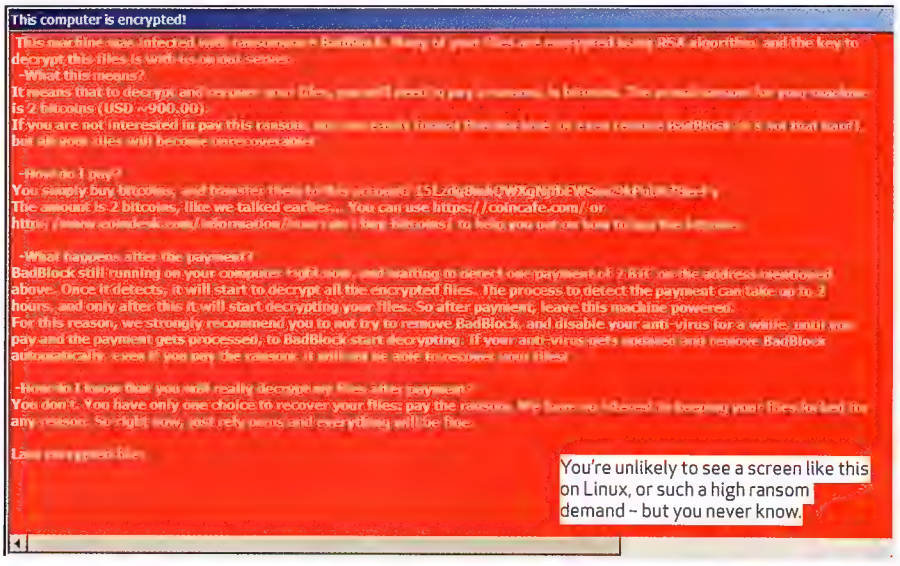
Unfortunately, if you fall victim to a ransomware attack and don't have any backups, it's probably too late to do anything about it. The usual asking price to unlock is around $500, though many variants will threaten to increase this amount after a couple of days, and may even threaten to make decryption impossible after longer. These threats just provoke anxiety in the victim, who's then more likely to pay up before considering the merits of doing so.

What is important to remember is that while there's a possibility that whoever's in control of this malware is reasonable enough to provide a decryption key, there's also the possibility that they won't. Their business model, after all, is to collect payments, so why should they bother with the extra admin of sending an email after that is achieved? It's not like people who receive a key will recommend that particular strain of malware to their friends.

Be that as it may, whether or not you have access to it a decryption key probably does exist somewhere. There is of course malware that just deletes everything – this class of malware is known as a wiper and would fall into the Chaotic Evil category in D&D – but this doesn't offer criminals much in the way of revenue generation. Since crypto is hard, the people peddling ransomware often get it wrong and it is possible to recover a decryption key without becoming a victim of extortion. To understand how this is possible, it's necessary to understand how all this key generation malarkey works.

Traditional symmetric encryption relies on two people being able to agree on a secret key by a secure channel. That channel might be a meeting in the woods, or sealed message delivered by a trusted intermediary. Today's numerous, distant electronic transactions do not allow us this luxury. We can't go whisper to our buddy at Paypal every time we want to pay for something online; every transaction requires a new key to be negotiated.

Fortunately we now have public key (asymmetric) encryption which


This computer is encrypted!
-What this means?
-How do I pay?
-What happens after the payment?
-How do I know that you will really decrypt my files after payment?

You're unlikely to see a screen like this on Linux, or such a high ransom demand – but you never know.

> "Ransomware that phones home to some central server could use symmetric encryption to perform its sordid garbling."

» MAKES YOU WANNACRY

The WannaCry damage could have been much worse had it not been for the actions of one Marcus Hutchins (aka MalwareTech), a security researcher who noticed WannaCry was trying to contact a server at an unregistered domain.

Feeling inquisitive, he duly registered the domain and set up a sinkhole, a server designed to capture information, which had the effect of neutering the malware. Once infected machines were able to contact this domain they stopped trying to infect other machines: in short, Hutchins had found a killswitch.

Further variants of WannaCry appeared in the aftermath, and mercifully killswitch domains were found for these too. Hutchins became something of a hero overnight, which makes the next part of the story quite upsetting. In August 2017 he was in Las Vegas attending the Def Con hacker conference, and was promptly picked up by the FBI on hacking charges relating to the Kronos banking trojan, to which he admitted contributing code as a teenager. In July 2019, Hutchins was effectively granted his freedom, with the judge sentencing him to time already served and even recommending he seek a pardon. This could have gone much worse for Hutchins; the plea deal he accepted could have seen him spend a decade in jail.

We've long commented that technology is moving faster than laws can keep up with. People doing security research have to walk a fine line. They are bound by a treaty known as the Wassenaar Arrangement, by which signatory nations agree to implement regulations governing software that could be used maliciously. The agreement was reworded in December 2017 to make special provisions for security researchers, who may have previously risked prosecution by sharing tools or vulnerabilities across borders.

Garn, put a bullet in our optical drive – we have backups and other PCs y'know.

enables us to negotiate a shared secret with a remote other party, be it a person or a machine, even if we've never met them. This is what underlies the key-exchange part of SSL/TLS (used in HTTPS), SSH and PGP communications. Public key crypto is also intrinsic to the workings of all cryptocurrencies. It's a fascinating subject, and also a strange concept to get your head around, but we'll leave you to ponder it at your leisure. All you need to know is that it requires parties to hold not one but two keys – a keypair; that only one of them needs to be kept secret; and that random numbers are involved.

Ransomware that phones home to some central server could use symmetric encryption to perform its sordid garbling. A random key and a unique identifier could be generated on the target machine and both of these numbers sent and then stored on that command and control (CC) server. All traces of the key would be removed from the victim's machine once files had been duly scrambled, and the unsuspecting victim would then send the requested ransom, together with their unique identifier to the extortionist.

Said extortionist, if they had any shred of decency, would then provide the decryption key and life would go on. This all relies on some degree of centralisation: somewhere out there a list of keys and tokens needs to be stored. For large-scale attacks this isn't ideal – often, multiple command and control servers are used for redundancy – and it makes more sense to somehow store those keys locally. Without public-key encryption this turns into a Catch-22 cascade of futility. You can encrypt the key and store it locally, but then where do you store the key used to encrypt that key?

Instead, an attacker can use a hybrid scheme whereby the symmetric key (or keys) used to scramble all the files is stored on the victim's machine, but encrypted asymmetrically. The simplest implementation of this type of scheme would require our attacker to only look after a single private key, while the public key could be stored locally – inside the decryption program, for example.

So in order to recover their files, the victim needs to pay the ransom, which releases the attacker's private key, which is combined with the public key and these two keys used to decrypt the locally stored symmetric key. Simple, right? Whoever said these people don't work for their money...

SCUM, VILE SCUM

Actually, they don't. Ransomware and command and control servers can be readily bought/rented via the darker recesses of the dark web and all this key management business can be taken care of with just a few clicks in a friendly interface. Having a single private key governing all victims is also not a terribly smart idea. It's straightforward enough to protect it as it's sent down the wire from the C2 server to the victim machine over HTTPS or SSH, but a suitably meticulous researcher would, given enough time and a retainer, be able to extract it from memory during the decryption phase. In this way, paying the ransom once (or maybe a few times) could provide decryption capability for everyone. Which is not really what malware authors want and why more advanced key distribution is generally used.

There have been a number of high-profile cases where ransom has been paid and data has been liberated. For example, in 2016 a hospital in Los Angeles coughed up 40 Bitcoins ($17,000 at the time) after being infected with the Locky ransomware. In life or death situations like this, it's easy to see why paying the ransom is a reasonable option. The sum of money involved may well be less than the daily cost of working around a crippled network.

Even if the crooks don't provide a decryption key, the ransom payment may be dwarfed by these costs, so from an accounting (but not awfully principled) point of view the victims aren't that much worse off. Hospitals, and indeed all reputable organisations, ought to have a watertight backup regimen in place, but restoring a whole network under considerable pressure is a complicated business. Consider how long it would take you to restore your machine's software stack, configuration and data after it was wiped, then multiply this number by at least several hundred. Locky evolved over 2016 to become one of the (then) most-detected pieces of malware in the wild, eventually being localised in 30 different languages and no longer requiring C2 infrastructure – which, if it's located in a friendly jurisdiction, is easy enough for authorities to shut down once an outbreak becomes prevalent enough.

Some malware is selective about what it encrypts; it may just encrypt documents (based on file extensions) and leave the rest of the OS intact. Doing this means it only requires user permissions to run. If you're lucky this means it's easy to clean up, at least once the source of the infection is tracked down and so long as backups were taken. Of course, people have come up with ingenious ways of hiding scripts and getting these infections to resurrect themselves. There's nothing more frustrating than thinking you've recovered everything to the pre-outbreak state only to have it all come undone.

'Fileless malware' is becoming the new norm. This often travels by poisoned documents (PDFs in particular) which contain some script or code to fetch hostile code from the internet and inject it directly into memory. This makes it terribly tricky to detect.

Social engineering

Convincing people to do things not in their interests has become quite the artform, so don't be fooled. Click here for puppies...

There are all kinds of devious ways that unscrupulous scammers will use to get hold of unsuspecting marks' data – whether it's tricking them to install ransomware or some other kind of malware such as a keylogger, or having them visit a booby-trapped website and enter valuable credentials. Most people nowadays know better than to reply to an email purporting to come from a Nigerian prince who needs some help organising a wire transfer for his considerable inheritance. Indeed, most scammers no longer bother with these kinds of ruses; their game has been considerably upped.

They may play on local events, especially natural disasters. They may also send targeted email based on public information harvested from the target's social media accounts. For this reason you should be awfully careful about what information you broadcast publicly about yourself. Knowing your interests, location or even those of your friends is enough to gain a data-mining foothold. WannaCry and others like it exploited an unpatched vulnerability in Windows to spread, but this is comparatively rare. Most ransomware, and indeed most unauthorised access to computers, is installed by unwitting users being schemed and duped.

Fraudsters will send email from domains that at a glance look legitimate or direct you to counterfeit websites at such domains. It's incredibly easy to cosmetically clone an entire website with open source spidering tools which have legitimate uses. Widgets and search facilities are harder to reproduce, but if you can dupe victims into thinking the site is real long enough for them to enter their username and password then you've already won. People tend to drop their guard considerably if they feel they are communicating with a friend, so contact lists from plundered email clients are valuable too. Social media accounts then become like gold for scammers.

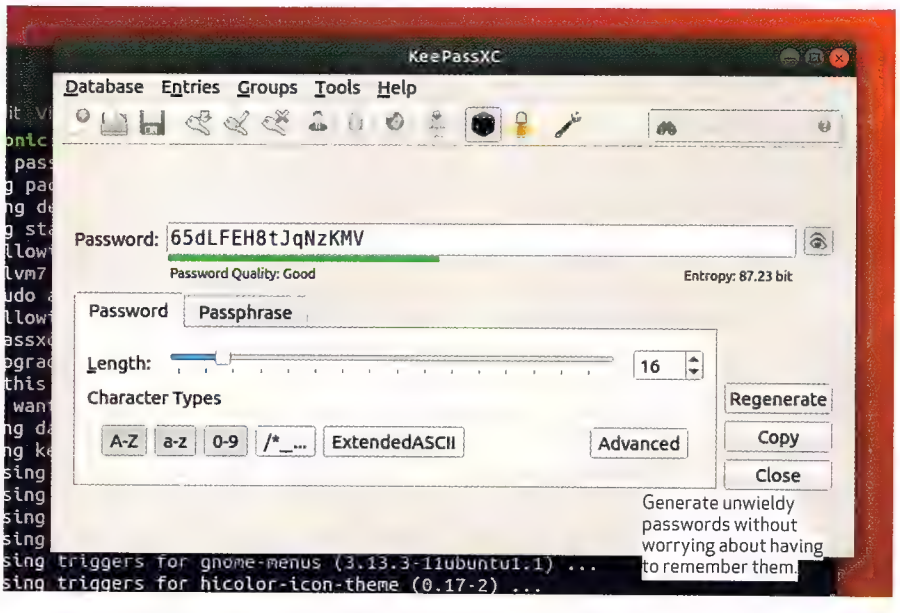
We'd rather you didn't use Facebook and such, but if you do, it offers a few ways you can secure your account. In particular, you can nominate a person or persons that you trust so that, in the event you get hacked, they will be able to trigger a password reset for you. You'll find these and other options in the Security and Login section of Facebook's settings.

You may have already witnessed hijacked accounts sending messages of the form "Help, I'm trapped in Timbuktu. Please send money", which are easy enough to sniff out. But with a little imagination and a little knowledge about the victim – and if you have access to their social media you'll have plenty at your disposal – a much more convincing con can be crafted. Concerned parents, particularly those that aren't too tech-savvy, will readily part with cash if they think their children are in some sort of danger.

Human beings aren't really designed to remember passwords or indeed come up with secure ones, so it should come as no surprise that password-reset mechanisms or forgeries thereof are popular means for hijacking accounts. If you search your email address on Troy Hunt's **https://haveibeenpwned.com** website, you may well find it has appeared on one of the many lists of breached credentials that are now forever in the public domain.

This doesn't mean that email address is compromised, just that an account associated with it has been published –

KeePassXC
Database Entries Groups Tools Help
Create a new KeePassXC database...
Encryption Settings
Here you can adjust the database encryption settings. Don't worry, you can change them later in the database settings.
Encryption Algorithm: AES: 256-bit
Key Derivation Function: Argon2 (KDBX 4 – recommended)
Transform rounds: 10
Benchmark 1-second delay
Memory Usage: 128 MiB
Parallelism: 2 threads
Simple Settings
Go Back
Continue
Cancel
KeePassXC's advanced settings are nothing if not impressive, but the defaults are fine for us.



Generate unwieldy passwords without worrying about having to remember them.

possibly something insignificant and maybe even something that has since been secured. For obvious reasons, the actual credentials aren't listed, so you can't check their validity. But doing a thorough password audit is never a bad idea. If a password you used on a forum 12 years ago that's similar to any you use today is in any way traced to a different account, that account is at risk.

It's a painful process, going through all the places where you may have signed up, resetting passwords or cancelling accounts as appropriate. But it might just save your identity, or prevent your contacts getting phished, or something else beneficent. Rather than trying to remember a bunch of secure and different passwords, it's much more sensible to use a password manager. That way you just need to remember a single strong password, and have the password manager generate (and remember) hard-to-crack, gibberish passwords for all the sites you use. There are plenty of cross-platform solutions that work through browser extensions and mobile apps, but there's a few that actually support desktop Linux too. Our favourite is KeePassXC (**https://keepassxc.org**), which is a fork of the largely unmaintained KeePassX (which itself was a fork of the Windows-centric KeePass). You can install an older (but still good) version straight from the Ubuntu repos with

```
$ sudo apt install keepassxc
```

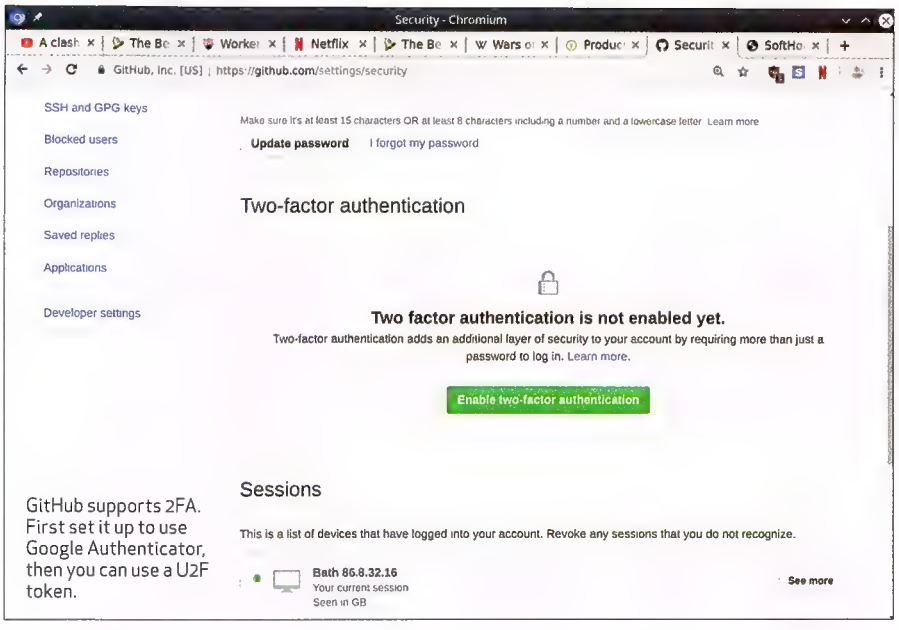
or use a snap to get a newer version with

```
$ sudo snap install keepassxc
```

Then fire it up from the Applications menu and click 'Create new database'. The default encryption and storage options are fine for normal humans, but feel free to turn everything up to 11. The next screen is the most important: it's where you must decide your master passphrase. Choose wisely, and consider writing it down somewhere and keeping it somewhere safe, but not somewhere it's likely to get stolen. Choose a location for your password database, and consider backing up this file (and all your important files) regularly. Now add your many, many freshly secured passwords. You can sort them into groups, and install the KeePassXC browser extension for Firefox.

A MATTER OF FACTOR

Many services now offer two-factor authentication (2FA), where besides a password some other token is required. Often this second factor is an SMS message, but there are problems with this. For one, a determined attacker may have the means to carry out a SIM-swap attack, whereby mobile network staff are socially engineered (or bribed or blackmailed) into porting the victim's phone number to an attacker's sim.


Security - Chromium
GitHub, Inc. [US] | https://github.com/settings/security
SSH and GPG keys
Blocked users
Repositories
Organizations
Saved replies
Applications
Developer settings
Make sure it's at least 15 characters OR at least 8 characters including a number and a lowercase letter Learn more
Update password
I forgot my password
Two-factor authentication
Two factor authentication is not enabled yet.
Two-factor authentication adds an additional layer of security to your account by requiring more than just a password to log in. Learn more.
Enable two-factor authentication
Sessions
This is a list of devices that have logged into your account. Revoke any sessions that you do not recognize.
Bath 86.8.32.16
Your current session
Seen in GB
See more
GitHub supports 2FA. First set it up to use Google Authenticator, then you can use a U2F token.

Mobile malware is becoming more and more prevalent (don't sideload apps you don't trust!) and if the victim's phone has fallen victim to such then their SMS messages will all be up for grabs. The SS7 protocol that connects cellular networks has long been a source of concern for the security conscious. Once you have access to any cellular network – whether that's internally through a rogue employee or externally by some devious hackery – it's actually possible to access any other network and intercept or reroute messages as befits your whim. So using SMS as a second factor is certainly stronger than using no second factor at all, but other factors should be used for critical services.

Hardware tokens and security keys are becoming much more widely supported as a second factor for popular services. The Challenge-Response card readers required by some forms of internet banking are an example; they add credence to the notion that it is the account holder trying to make a given transaction by proving that whoever is doing so has their card and PIN number. Unfortunately, these devices tend to spend most of their time getting lost or running out of battery at the most inopportune moments.

That's the problem with real-world security: it has to take into account all the silly mistakes real world humans are so good at. Stay safe!

» WE SECOND THIS MOTION

Google's Authenticator app for Android is a software 2FA solution, albeit a proprietary one, that uses the Time-based One-time Password protocol (TOTP) to generate six- to eight-digit one time codes for use as a second factor.

It's widely supported, not just on Google sites, so if you have an Android phone this is a free way to boost your security and reduce the chance of unfortunate takeovers. The magic of this is that, once a token is generated and shared between the site and the app, the same code is generated independently based on the current time. The algorithm can tolerate clock skews and network latency, so the app and the site don't need to both keep exactly the same time. Authenticator codes can theoretically be spied on, though an attacker would have to be watching you in real time for this to work, so for ultimate security we recommend using a hardware solution such as one of Yubico's YubiKey range. These support a variety of authentication protocols. It can work in tandem with a TOTP app as a Universal Second Factor (U2F), or it can authenticate with supported services via NFC (Near Field Communication) on a mobile phone. It can also work as an unlock key for a password manager service. Which is nice.

Yubic's YubiKey range covers most platforms.

System News

Ripping threads off a Cascading Lake of X's, Mark Williams is enjoying the heated HEDT competition.

For many years Intel's High-End Desktop (HEDT) range has been the platform for higher tier enthusiasts or prosumers that need more than what the regular consumer grade parts have to offer. HEDT has typically offered more cores than consumer parts, more IO and connectivity options, plus higher RAM capacity support and more memory channels. Basically, if you want to beat your chest and boast about how big your numbers are, or you really do need the extra grunt for the things that you do, HEDT is the place to be – if you can afford it.

Another unique feature of Intel's HEDT platform is that due to the popularity of the platform for use in business and enterprise workstations, Intel supports each HEDT series across two or three CPU product refreshes – giving businesses a clear and guaranteed upgrade path for these more expensive platforms, making them a good long-term investment. In the case of the current X299 platform, the LGA 2066 socket supports Intel's Core 7000X and 9000X series CPUs and the just-announced (and crazily numbered) 10000X series.

The current lay of the land in this segment for market share is clearly in Intel's favour, however AMD, through its Ryzen and Threadripper series of CPUs, is making inroads on Intel's turf thanks to a very aggressive ramp up of core counts on its consumer products – currently 12-core in the Ryzen 9 3900X, but soon to be a massive 16-core in the soon to drop Ryzen 9 3950X – both of which are well into Intel's HEDT territory for performance, and on cheaper consumer-grade hardware. That's crazy.

Then there're the Threadrippers, offering up to a massive 32-cores in the 2990WX. AMD is leaving Intel behind on raw core counts in this segment, which for Intel tops out at 18-cores in the Core i9 9980XE. Not to mention useable PCIe lanes.

So, Intel's HEDT space is getting pinched from above and below by AMD. Its response? Massive price cuts! Intel's soon to be released Cascade Lake-X series will slash the asking price for its refreshed line-up compared to the last generation. There are a few tweaks here and there over the 9000X series, like 200MHz higher turbo clocks, four more PCIe lanes for 48 total and faster memory support (2933MHz) plus higher system memory capacities (up to 256GB). But the most exciting part is that the average per-core cost is reducing from US$103 down to US$57 – basically half price! This is a massive move by Intel – a company that's been able to avoid a price war for a decade. It not only signifies that Intel are now seeing AMD's products as a direct threat, it also shows just how much of a profit margin Intel used to have on the products. 50% of the price is *pure* profit!

With AMD about to finally ship the long waited 16-core Ryzen 9 3950X, and soon announce its Threadripper 3000 series (predicted to possibly sport up to 64-cores!), this is a move Intel had to make to remain competitive. It's great for current Intel HEDT users as it'll offer them half-priced upgrade options and it's great for AMD users too, as it'll keep prices in check and force more innovation and advancement in what was for quite a while a slow-moving stagnant segment of the market. As Jaimie from Leader Computers said in his Shop Talk comment for us this issue "the winner is the consumer".

SHOP TALK

Has Intel done enough with the 10th Gen X-series to hold off AMD in the HEDT space?

Jaimie, Leader Computers:
"With that [50% lower] pricing being thrown about it sounds like Intel have finally acknowledged that they have a fight on its hands. I still believe on paper and in reality AMD will have the edge, but there are far more Intel fans than AMD in HEDT, so many of them will still pay a premium to get their performance level in Intel rather than AMD, I think the new pricing structure is smart on Intel's part, they will win back market share while still demanding a relatively premium price. Whichever way it rolls out, the winner is the consumer, as a good level of competition means fairer prices for our customers!"

John, TI Computers:
"Intel holds its position in the HEDT space against AMD with its great reputation over the years in terms of performance and reliability, despite the aggressive challenges from AMD with its Threadrippers. Considering HEDT users generally value reliability over performance and expansion capability, with Intel catching up their core count, PCIe lanes, even pricing, I am confident Intel is still going to be in the leading position in this field, at least for this generation. We are indeed keen to see good outcome from competition. However, once AMD build its reputation in reliability, it may be a different case."

Market Snapshot

A sampling of PC systems available this month.

PC Case Gear Venom 2080

$2,699 TINYURL.COM/APC474PCC

This system is purely focused on gaming and achieving the best performance without breaking the bank. It's certainly costly but it's not over the top. This laser focus on value, though, has resulted in some compromises. Simply put, Intel CPUs are best for gaming in general thanks to their high clock speeds. However, due to Intel's manufacturing shortages they're currently far more expensive per core. In order to keep costs down this build serves up a non-overclockable and slower i7-9700 (compared to the K variant) which is seated in a rather low-end motherboard with limited expansion and rear IO, and only given 256GB of SSD capacity. This system will play games faster than all the others featured this month thanks to the included mighty RTX 2080.

KEY SPECS: CPU: Intel Core i7 9700 **COOLER:** Cryorig M9I **MOTHERBOARD:** Asus Prime B365M-K **GRAPHICS:** Asus ROG Strix GeForce RTX 2080 Advanced 8GB **MEMORY:** Corsair Vengeance RGB Pro 16GB DDR4 3200MHz CL16 **STORAGE:** Adata XPG SX8200 Pro M.2 NVMe SSD 256GB, Seagate Barracuda 2TB HDD **POWER SUPPLY:** be quiet! Pure Power 11 600W **CASE:** Phanteks Eclipse P350X.

Mwave S69a

$2,699TINYURL.COM/APC474MWV

Last month we featured the S66a, a PC that was $1,100 more than this S69a, yet when it comes to games, the two would perform about the same. This build cuts the excess and focuses on the essential gaming performance. The same Ryzen 7 3700X CPU still feeds an AMD RX 5700 XT, which is on the level of a GeForce RTX 2070's performance, and good for 1440p high detail gaming. The stock air cooler saves on costs and is perfectly adequate if you're not looking to overclock. 16GB of RAM and 1TB of NVMe SSD storage is also on point for the price and performance metrics. The X570 motherboard is a little over the top given the inbuilt PCIe 4.0 isn't taken advantage of in this build, but it does offer the best expandability going forward.

KEY SPECS: CPU: AMD Ryzen 7 3700X **COOLER:** OEM **MOTHERBOARD:** Asus Prime X570-PRO/CSM **GRAPHICS:** Asus Radeon RX 5700 XT 8GB **MEMORY:** Adata XPG Spectrix D60G 16GB DDR4 3200MHz CL16 RGB **STORAGE:** WD Black SN750 1TB NVMe M.2 **POWER SUPPLY:** Unknown **CASE:** NZXT H510 Elite.

TI Computers AMD 3700X Gaming PC

$2,085 TINYURL.COM/APC474TIC

Coming in over $700 cheaper than the Mwave system this month you'd think this system would be the worse performer of the two. On the surface it would appear to not be the case and should even outperform it! The same AMD Ryzen 7 3700X CPU powers both systems and provides a lot of compute performance, however this system sports an RTX 2070 Super, which edges out the 5700 XT handily in most situations. It seems the cost savings mostly come from going with a mid-range motherboard, SSD and a cheaper chassis. As long as the motherboard has all the connectivity and IO you desire and 500GB of mass storage is enough, this is quite a hard deal to pass up.

KEY SPECS: CPU: AMD Ryzen 7 3700X **COOLER:** Cooler Master Hyper 212 Cooler **MOTHERBOARD:** Asus B450M **GRAPHICS:** Geforce RTX2070 Super 8GB **MEMORY:** Kingston HyperX 16GB DDR4 3200MHz **STORAGE:** 500GB Intel M.2 SSD **POWER SUPPLY:** Cooler Master 750W **CASE:** Deepcool Matrexx 55.

Scorptec Eridium RTX 2070 Super

$2,699 TINYURL.COM/APC474SCR

$2,699 seems to be the price point of the month. With this build Scorptec appears to have moved down one step on the graphics front, relative to the Venom system, in order to redistribute your money elsewhere in the system. As a result, this is a much better-balanced build. The CPU foregoes the IGP which saves a little money as well, but importantly keeps the 4.9GHz boost clocks and remains overclockable. The factory overclocked RTX 2070 Super is in spitting distance (-5%) of a regular RTX 2080, so not much gaming performance is lost but we gain a better cooler, a motherboard with lots more expandability and IO, plus there's double the SSD capacity.

KEY SPECS: CPU: Intel Core i7 9700KF **COOLER:** Corsair Hydro H60 (2018) **MOTHERBOARD:** MSI MAG Z390M Mortar **GRAPHICS:** MSI Ventus GeForce RTX 2070 Super OC 8GB **MEMORY:** Corsair Vengeance RGB Pro 16GB 3000MHz DDR4 **STORAGE:** Western Digital WD Blue 500GB M.2 SSD, Seagate BarraCuda 2TB HDD **POWER SUPPLY:** Corsair Vengeance 650M 650W **CASE:** Corsair iCue 220T RGB Black.

PC blueprints

The *APC* team's picks for a part-by-part perfect PC build to suit your budget.

PARTS LIST

PART		PRICE
CASE	BITFENIX NOVA TG	$75
PSU	CORSAIR VS450 80+ WHITE 450W	$55
M/BOARD	ASROCK B450M R4.0 AM4	$120
CPU	AMD RYZEN 5 2600 **NEW**	$199
GPU	GIGABYTE GEFORCE GTX 1660 OC 6GB **NEW**	$379
RAM	8GB (2X 4GB) TEAM T-FORCE VULCAN Z @ 3,000MHZ	$79
SSD	120GB CRUCIAL BX500 2.5-INCH	$30
HDD	1TB WD BLUE 3.5-INCH HDD	$59
OS	UBUNTU DESKTOP LINUX 18.04 LTS 64-BIT	$0
APPROXIMATE PRICE:		$996

Prices have been climbing across the board this month, much to our frustration. Even the trusty Crucial BX500 cost us a few dollars more, although it refused to be unseated from its throne as the king of bargain-bin storage. Team Group's T-Force Vulcan Z memory also remained the best-value 8GB kit around. There wasn't much we wanted to change; rising GTX 1660 prices necessitated a quick switch over to a Gigabyte model of the GPU, although we were tempted by the similarly priced single-fan 1660 Phoenix from Asus. The main change this time around was downgrading back from the AMD Ryzen 5 2600X to the regular 2600, retaining the six-core model, but losing 0.2GHz of base clock speed.

PARTS LIST

PART		PRICE
CASE	FRACTAL DESIGN MESHIFY C	$149
PSU	500W EVGA 500 BR 80+ BRONZE **NEW**	$72
M/BOARD	GIGABYTE X570 UD **NEW**	$259
CPU	AMD RYZEN 5 3600X	$375
COOLER	AMD WRAITH SPIRE	N/A
GPU	SAPPHIRE RADEON RX 5700 8GB	$699
RAM	16GB (2X 8GB) TEAM T-FORCE DELTA RGB @ 3,200MHZ **NEW**	$149
SSD	250GB SAMSUNG 970 EVO PLUS M.2 PCIE	$159
HDD	1TB WD BLUE 3.5-INCH HDD	$59
OS	WINDOWS 10 HOME 64-BIT OEM	$140
APPROXIMATE PRICE:		$2,061

Only a minor saving on the mid-range build this time around, primarily found in a small price drop on the Ryzen 5 3600X. X570 motherboards have remained expensive, and while we're hoping for a price drop soon, we've had to switch to the Gigabyte X570 UD in the meantime to maintain our overall build price. Following that, we also switched up the memory, using Team Group's flashy T-Force Delta RGB to keep our price and performance the same while adding a little more pizazz to this rig. While we did explore other possibilities regarding the GPU, the fact remained that Sapphire's Radeon RX 5700 was still the best value card for this system.

UPGRADE OF THE MONTH

512GB Samsung 970 Pro M.2 NVMe SSD

$209, SAMSUNG.COM

Thanks to the arrival of PCIe Gen 4.0, slightly older Gen 3.0 M.2 drives are becoming more affordable, so now's a great time to pick one up if you haven't yet upgraded to a new X570 motherboard. The 970 Pro is an awesomely fast product, perfect for workstations or gaming PCs, with a maximum read speed of up to 3,500MB/s. With a nickel-coated heat spreader and a five-year limited warranty, there's very little to dislike about this drive. Even if you are rocking a Gen 4.0-compatible motherboard, this is still an excellent SSD.

> "A bit of evaluation determined that 360mm of radiator space was overkill for cooling the Threadripper 2950X, so we swapped it out for a 240mm AIO cooler from the same Fractal Design product line."

There were a few things to tweak on our turbo build this month. A bit of evaluation determined that 360mm of radiator space was overkill for cooling the Threadripper 2950X, so we swapped it out for a 240mm AIO cooler from the same Fractal Design product line. Regarding the processor itself, we're taking an "if it ain't broke, don't fix it" approach and sticking with the 2950X. The X399 Phantom Gaming 6 from Asrock remains the best-value X399 motherboard on the market, so there's no need to get rid of that either.

When we came to the GPU, we saw that last issue's "Upgrade of the Month" (the EVGA GeForce RTX 2070 Super Black) had risen in price, so we've gone for a more conservative option: the Zotac Gaming RTX 2070 Super. This twin-fan model is cheaper than EVGA's card, and has nominally the same performance. We also swapped out the RAM to a slightly more affordable Sniper X kit from G.Skill, keeping the capacity and speed the same to ensure that this system doesn't experience a drop in performance.

Lastly, with the cash we saved, we decided to upgrade the SSD to a Samsung 970 Pro, netting us faster transfer speeds and 12GB of extra storage. PCIe Gen 3.0 M.2 drives have dropped significantly in price since the release of the new Gen 4.0 motherboards and SSDs, and we're very happy to take advantage of that fact. ■

PARTS LIST

PART		PRICE
CASE	NZXT H700I	$219
PSU	850W CORSAIR TX-M SERIES 80+ GOLD	$179
MOBO	ASROCK X399 PHANTOM GAMING 6	$275
CPU	AMD THREADRIPPER 2950X	$1,179
COOLER	FRACTAL DESIGN CELSIUS S24 BLACKOUT 240MM AIO **NEW**	$169
GPU	ZOTAC GAMING GEFORCE RTX 2070 SUPER TWIN FAN 8GB **NEW**	$859
RAM	32GB (2X 16GB) G.SKILL SNIPER X @ 3,200MHZ **NEW**	$498
SSD	512GB SAMSUNG 970 PRO M.2 NVME **NEW**	$209
HDD	2X 3TB SEAGATE BARRACUDA COMPUTE	$360
OS	WINDOWS 10 HOME 64-BIT OEM	$140
APPROXIMATE PRICE:		$4,087

"As you might expect, we're dealing exclusively in ultra graphical settings. Our goal was to create a system capable of running just about any game at 1440p ultra, at 60fps or better."

A Super gaming machine for $3K

The new RTX Super cards from Nvidia seem almost too good to be true – let's put one to the test in a gaming build.

Nvidia's "Super" variants of the GeForce RTX range have proved divisive, with some loving the improved performance sans price increase, while others disparage the modest performance gains. For our money, the Super cards are pretty good; however, the 2060 Super loses points for costing $50-$100 more than the original 2060, and the 2080 Super doesn't hit the 4K performance levels we wish it could. That leaves the RTX 2070 Super, our personal favorite, and arguably the best 1440p GPU on the market. The Super version performs about 15 percent better than the original RTX 2070, and it doesn't cost a cent more.

That card is the focal point of this build, a future-proofed system designed to handle high-quality 1440p gaming for years to come. That means we're looking at a cut above the usual components, although we've tried to trim costs in other areas. With a target price of $3,000, things were tight; we're still pushing the new generation of PCIe 4.0 components, which drives up the price across the board – no pun intended. We opted for the latest Gen4 SSD to take advantage of the X570 platform, and that pushed us over our budget target, but we think it's worth it.

As you might expect, we're dealing exclusively in ultra graphical settings. Our goal was to create a system capable of running just about any game at 1440p ultra, at 60fps or better. That includes new releases – with the likes of *Cyberpunk 2077* and (hopefully) *Death Stranding* on the horizon, this rig needed to be capable of handling future titles. Versatility was a factor, too. A system that is difficult to upgrade is nobody's friend, so potential for easy expansion and improvement was a must. So here we go: What should be a straightforward build. Was it, though? Read on....

SUPER-POWERED

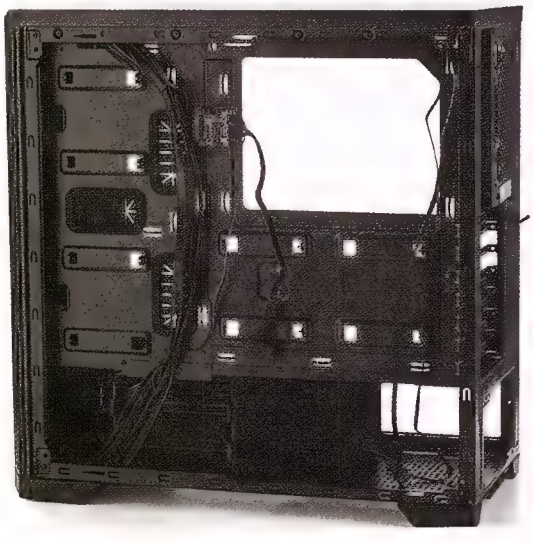
In addition to the belle of this ball, Zotac's Gaming RTX 2070 Super AMP Extreme, this system is packing some pricey parts. At the center is the new Ryzen 7 3800X from AMD. If you're planning on building this system, we recommend waiting until this CPU is back in regular stock; some resellers are exploiting product shortages to charge exorbitant prices for the 3000-series Ryzen chips. That processor is going on an X570 motherboard, Asrock's X570 Taichi. The steampunk appearance and low-key RGB lighting matches well with the LEDs of our AMD Wraith Prism cooler – the stock cooler for the 3800X, which performs admirably despite coming with the chip at no extra cost. Next is memory; we've opted for two DIMMs of G.Skill Trident Z at 3,200MHz. We did contemplate using two 8GB sticks, but decided that 32GB was a more reliable long-term choice, so opted for the 2x 16GB kit instead.

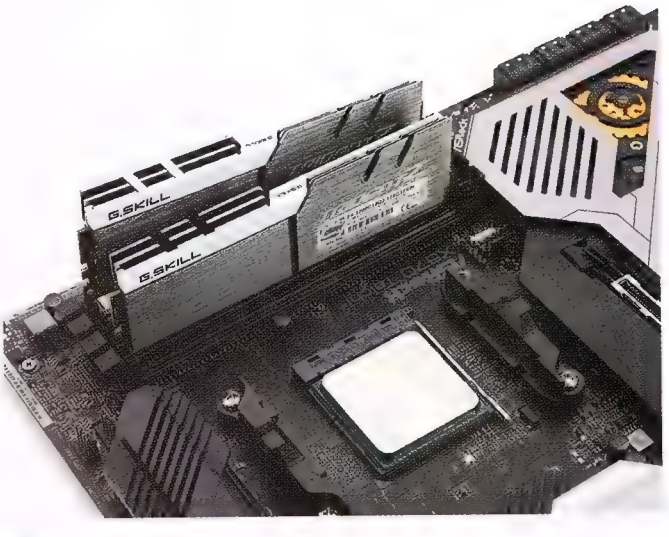
Storage-wise, we've chosen a 1TB Corsair MP600 M.2 SSD, an NVMe Gen4 drive that will provide speedy transfers. There's potential for easy storage upgrades here; the BitFenix Saber case we're using has a drive cage with slots for two 3.5-inch HDDs, or mountings for up to eight SATA SSDs. Aside from that, the Saber also comes with two case fans and some fairly neat RGB lighting on the front panel. There's a strange little plastic cover over the triangular power button, too – we're not sure what purpose that's supposed to serve. A shield against rage-quits, perhaps?

Lastly, we're powering this rig with a Corsair RM750x PSU. 750W is superfluous for such a system, but it leaves room for upgrades without needing to replace the power supply. The RM750x's modular design makes installation easier, too; a must-have feature, given that the Saber's drive cage is welded to the base, leaving little room for errant cabling to be tucked away.

PARTS LIST

PART		STREET PRICE
CASE	BITFENIX SABER	$109
MOTHERBOARD	ASROCK X570 TAICHI	$479
CPU	AMD RYZEN 7 3800X	$609
CPU COOLER	AMD WRAITH PRISM (STOCK COOLER)	N/A
MEMORY	32GB (2X 16GB) G.SKILL TRIDENT Z 3,200MHZ	$349
GPU	ZOTAC GAMING GEFORCE RTX 2070 SUPER AMP EXTREME	$949
PSU	750W CORSAIR RM750X 80+ GOLD	$189
STORAGE	CORSAIR MP600 FORCE SERIES GEN4 1TB M.2 SSD	$398
OS	WINDOWS 10 HOME 64-BIT	$140
TOTAL		$3,222



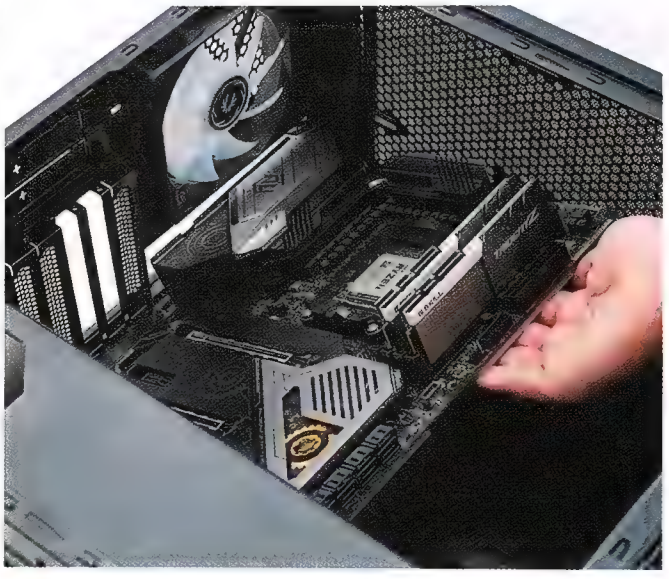


1 GETTING PREPPED

As usual, we start with a full case stripdown. There are a lot of cables to contend with, and not much space to work in. Remove both side panels, but leave the main bundle of cables from the front I/O tied up; they'll only get in the way otherwise. What you do need to do is untie the cables from the case fans, and feed them through to the back of the motherboard mounting plate, removing any slack inside the main case cavity that will hinder the installation process. Lastly, be sure to remove the cardboard box from the drive cage tray, because this contains some screws and cable ties we'll use later on.

2 IN MEMORIAM

Before we situate the motherboard inside the case, we'll need to install some components on it. First up is the processor. This is a cinch if you've done it before, and easy enough if you haven't: Simply lift up the metal retention arm on the CPU socket, drop the chip into place – being sure to line up the gold triangle on one corner with the triangle on the socket – then lower the retention arm back down to secure the processor. With that done, it's time to move on to the memory. The X570 Taichi only has clasps on one side of the DIMM slots; open them, and fit the memory to slots A2 and B2 (these are the primary memory slots – use others, and the XMP profile for 3,200MHz is liable to fail). Push down on each stick until the clasp clicks into place, then push down on the opposite end to ensure that it is properly fitted.

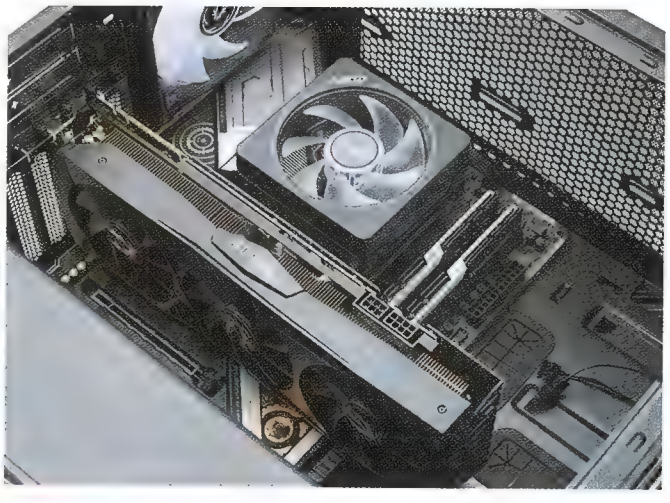


3 HEATED DISCUSSION

This is where things get more complicated. Both the M.2 drive and motherboard come with a heatsink and thermal pads for passive cooling of the drive; we're going to use the motherboard's large heat spreader, although it can be removed. Remove the heatsink from the Corsair MP600 by pulling the clips on either side and levering the metal sink from the top of the drive. The drive may come with the sink as you remove it – simply peel it off the sticky heat pad. Next, remove the three Allen screws on the X570 Taichi's heat spreader and lift it up, taking care not to damage the attached cable (this powers the RGB lighting). Screw the MP600 down in the middle M.2 slot, then replace the heat spreader, remembering to remove the plastic cover on the sticky pad before doing so.

4 NOW BOARDING

With your components attached, it's time to situate the motherboard in the case. Lower the board in carefully, lining up the rear I/O, and fitting it to the central mounting peg. Using the screws from the Saber's accessory box, secure the board at the eight fastening points around the edges. This can be difficult, due to the relatively small size of the Saber and the bulkiness of the Taichi. Be careful not to drop the board; even though it has a heavy armored plate on the rear, other components don't have the same protection. Once the board is secure, untie the front I/O cables, and plug in all of them except the USB connector – we'll get to that later. You can also plug in the case fans – use the standard three-pin connector for the front fan, not the larger direct power connector.



5 COOL AND COLLECTED

The last things to add to the motherboard are the cooler and CPU. We're using the stock cooler for the Ryzen 7 3800X, the Wraith Prism. This attaches using a standard AMD cooler bracket, which should be pre-installed on most X570 boards. Put a small glob of thermal paste on the CPU, then attach the metal clasps to either side of the bracket, and pull the fastening lever across until it snaps into place. Don't forget to plug the power cable into the motherboard's CPU fan connector, too. Once done, remove two blanking plates from the back of the case, then lower the GPU into the PCIe slot. Make sure it clicks into place, then screw it down with the thumbscrews from the blanking plates. The RTX 2070 Super AMP Extreme is a big card, so ensure it's secured before placing the case upright.

6 MODULAR MANAGEMENT

The last step is to provide power. The Corsair RM750x is a large PSU, so you need to plug in all the necessary cables to the modular rear of this big white brick before you install it. In addition to the large motherboard power connector, you need an eight-pin CPU power connector, a GPU power cable that splits into an eight-pin and six-pin connector, and one SATA/accessory cable. Getting the PSU in can be a squeeze, although once it's screwed into the case, feeding through the cables is straightforward. Cable management can be a tall order in this case; there's not much room behind the motherboard, and the drive cage is riveted in place, taking up a fair amount of otherwise useful space for routing cables. This isn't likely to be the tidiest of builds, but with some cable ties and a mild amount of exertion, we can hide the bulk of the cables out of sight behind the motherboard.

1 This rear fan actually has RGB lighting, but there aren't enough RGB headers on the motherboard to support it.

2 Getting the G.Skill Trident Z memory running at its requisite 3,200MHz was simple enough, demanding only a quick trip into the BIOS to turn on the XMP.

3 Zotac's triple-fan take on the RTX 2070 Super puts power over presentation, with a basic black appearance, and only a softly glowing Zotac logo for lighting.

4 The front case fan can be easily removed, or supplemented with two additional fans – one above and one below.

Harder than Expected

Performance-wise, this machine did great. Even the demanding *Ghost Recon: Wildlands* was able to crack 60fps at 1440p max settings, and the high-end components comfortably outpaced the zero-point in our benchmarking software tests.

When we examine options for our monthly "Build It," the decisions are easy to make right now; the high-speed transfers of NVMe Gen4 SSDs make them an obvious choice, which necessitates the use of an X570 motherboard, and subsequently a Ryzen 3000 series CPU. We're not complaining, though, as the new Ryzen chips perform admirably, their only major drawback being a lack of significant overclocking headroom.

The downside with using these next-gen components is a lack of variety, but that should be resolved as more manufacturers put out their own takes. We often have to work with the hardware we have to hand, so feel free to swap out the motherboard or drive for the Gen4 model of your choosing. We recommend sticking with the Zotac RTX 2070 Super, though, as it's an excellent card, and a swathe of sales on the Super cards makes them a great purchase right now.

With hindsight, we might reconsider the use of the BitFenix Saber. While the symmetrical front lightbars look fantastic, and the $109 price tag is decent, considering the sturdy metal construction and tempered glass side panel, working inside it was a challenging experience. A lack of routes and holes for cables was a particular frustration. A smaller PSU might also have been a wise choice, as the chunky RM750x was a tight fit. There's no way we'd use a non-modular PSU in this case, though, due to the obstruction caused by the drive cage.

Speaking of which, one thing we definitely like is the potential for easily adding extra storage. The two drive cage trays can take a 2.5-inch SATA SSD or a larger HDD, and there's lots of space for other SATA drives in six mounting positions. There's also potential for easy RAM or GPU upgrades, but they shouldn't be necessary for a long time.

Although the Wraith Prism is very good, if you are planning on trying to overclock the CPU, you may wish to invest in a more robust cooling solution. The last point of contention is RGB lighting control. The X570 Taichi only has one header for RGB connections, which we hooked in to the Saber's front lightbars, leaving the rear fan unlit. The BitFenix hardware connects to RGB control software, but unless you're willing to buy a third-party controller, you're out of luck. ■

BENCHMARK RESULTS

	ZERO-POINT	THIS SYSTEM
CINEBENCH R15 MULTI (INDEX)	959	2,004 (109%)
CRYSTALDISK QD32 SEQUENTIAL READ (MB/S)	3,442	4,988 (45%)
CRYSTALDISK QD32 SEQUENTIAL WRITE (MB/S)	1,706	4,286 (151%)
RISE OF THE TOMB RAIDER (FPS)	95	116 (22%)
TOTAL WAR: WARHAMMER II (FPS)	55	75 (36%)
TOM CLANCY'S GHOST RECON WILDLANDS (FPS)	48	61 (27%)
3DMARK: FIRE STRIKE (INDEX)	9,128	22,214 (143%)

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our zero-point consists of an Intel Core i5-8400, 16GB (2x 8GB) of Corsair Vengeance LPX @ 2,666MT/s, an MSI GeForce GTX 1080 Armor, and a 500GB Samsung 960 Evo M.2 PCIe SSD. All tests were performed at 1440p at the highest graphical profile.

howto

» QUICK TIPS

Experts solve your computing problems

APC and its readers can be one giant helpdesk. If you have a technical problem, chances are one of us can solve it.

HARDWARE

LAPTOP SCREEN PROBLEMS

I have a HP 15-ac152sa laptop that I purchased in 2015. I switched it on recently, and the display showed some kind of tearing effect. Is it worthwhile getting a replacement screen, or can you advise me on a similar model or two-in-one model to replace it?
Maranda Greenidge

This might be anything from a loose cable to a failed screen. If you felt brave enough you could try and track down a service manual, then follow the disassembly instructions to see if the problem is as simple as reconnecting (or replacing) the ribbon-like cable that connects the display to the motherboard. If the screen was faulty, a replacement would cost you around $100 including delivery from a screen parts specialist – this assumes you can fit the screen yourself. Alternatively, shop around online for a fully fitted service where a local supplier might come to your location or offer a pickup/return service. While you might be tempted to purchase a new laptop, we think your machine has a good few years of life left in it, once the screen is fixed, thanks to its spec (8GB RAM, Intel Core i5 fourth-generation chip). For around $300 you could replace the screen and switch its hard drive to a 500GB SSD, which would have a noticeable effect on performance, and would be much better value than forking out on a whole new laptop.
Carrie Marshall

WINDOWS

FILE EXPLORER ISSUES AFTER MAY UPDATE

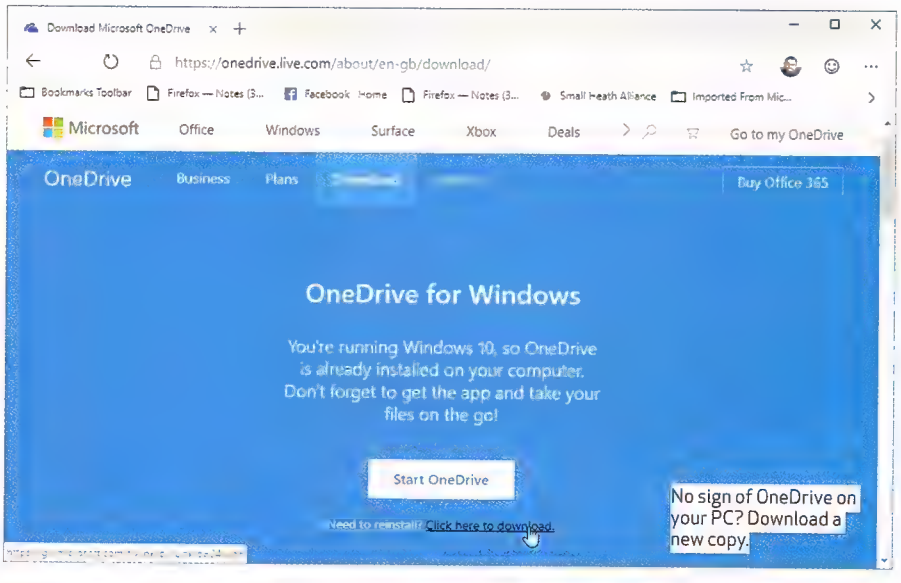
Since the last big May update, I've lost both OneDrive and Format from File Explorer. I don't use OneDrive, so is it important? However, I do need format for my discs.
Terry Clark

Unfortunately, Terry didn't respond to our follow-up email, so we can only give generic advice. Regarding OneDrive, it's not needed so can be safely ignored if you're not using it. If you are, check it's present under 'Start > Settings > Apps > Apps & features' under Microsoft OneDrive. Visit **https://go.microsoft.com/fwlink/p/?LinkId=248256** for a direct link to the installer file. Regarding the missing Format button, this may indicate a deeper problem with your DVD writer and Windows itself – start by downloading and running FixWin 10 (**https://bit.ly/fixwin10**), then selecting 'Troubleshooters > Hardware and Devices Troubleshooter'. If this doesn't work, go to **https://support.microsoft.com/kb/314060** and follow the steps from method 3 onwards to see if the suggestions offered can fix your problem.
Nick Peers

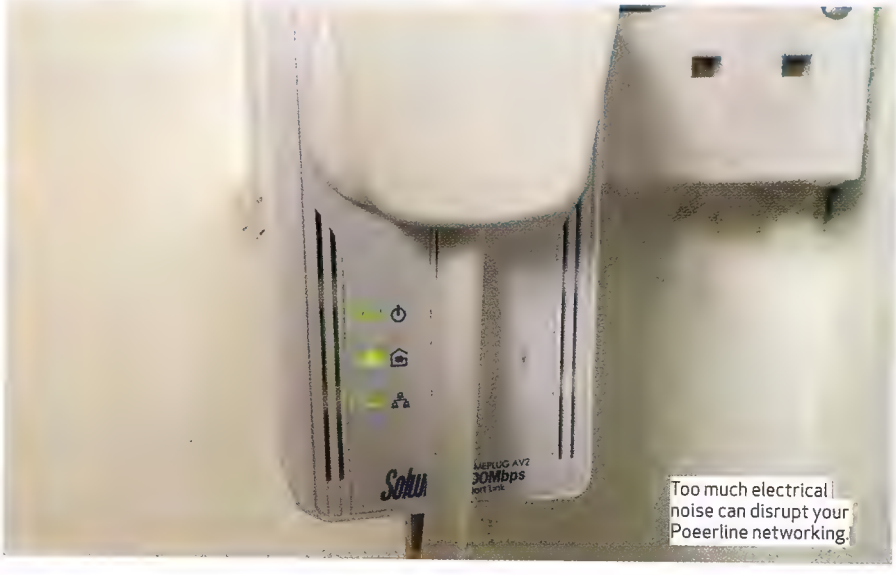
NETWORK

TROUBLESOME HOMEPLUG NETWORK

In recent weeks I've discovered my home wired network – which includes no fewer than four HomePlugs to extend it to different rooms in my house – has started to play up. I'll periodically lose access to the router from my PC, while my wireless devices continue to



No sign of OneDrive on your PC? Download a new copy.


Too much electrical noise can disrupt your Poeerline networking.

Using the Time Machine app is the only safe way to remove infected files from your Time Machine backup.

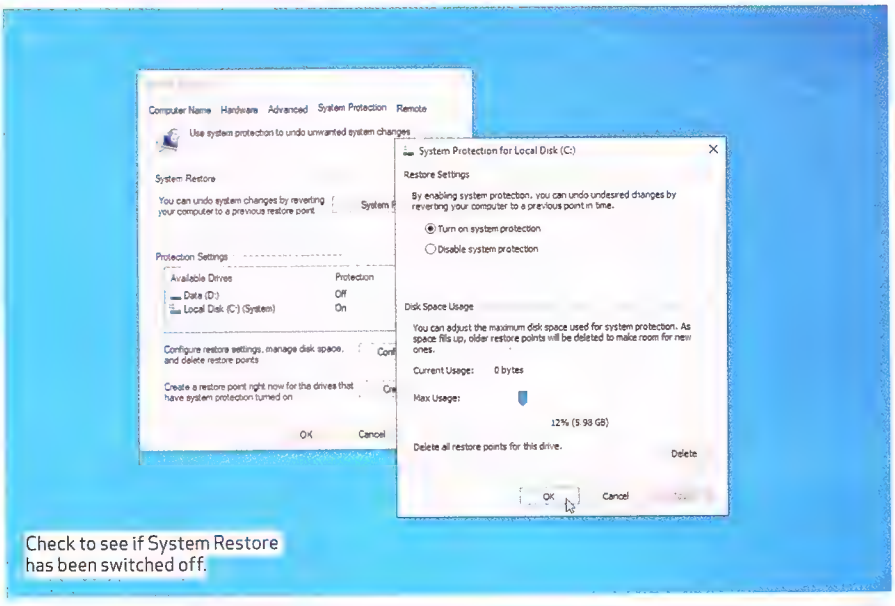
function fine. What's happening? Dodgy router?
Richard Telford

In the course of troubleshooting this problem, we stumbled on the answer: electrical line noise. The more devices on an electrical circuit, the greater the interference generated. Richard had recently fitted new sockets to his front room to eliminate an eight-plug extension lead. This extension had a built-in noise filter. Removing it, and plugging devices directly into the mains, meant interference was being generated on his network. Switching off one of the HomePlugs, along with an Ethernet-connected security camera, fixed the problem, but now Richard has to work out how to balance his electrical needs with his network ones.
Ian Sleightholm

SECURITY
MY BACKUPS ARE INFECTED

Out of the blue, my antivirus software has started informing me that two old documents in my Time Machine backup contain W97M viruses. As they can't be modified, what can I do?
John Craddock

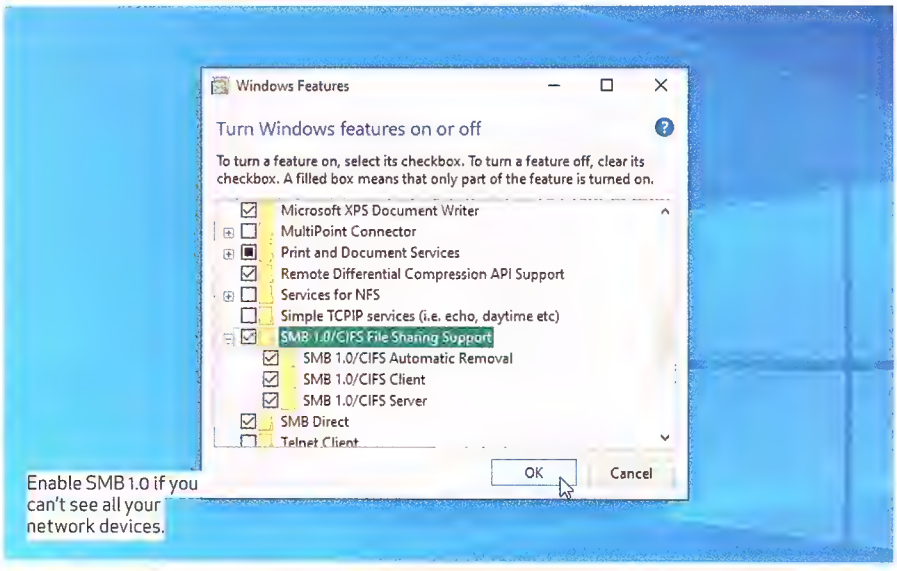
They're almost certainly spurious false positives. But before assuming they are, ensure that all other storage connected to your Mac is as clean as a whistle.If any viruses are detected there, that could indicate a genuine problem. Most antivirus products look for files with suspicious signatures. When their definitions are updated, they sometimes gain new signatures that trigger warnings incorrectly in this way. Check with the vendor's support site and forums to see if other users are reporting similar problems. Use the app's settings to exclude the files from scans. Consider switching to a more reliable antivirus tool, such as Malwarebytes (**malwarebytes.com/mac**) or DetectX (**sqwarq.com**), which don't appear to be as prone to such false positives. If you do think these files might be infected or infectious, you'll need to delete them using the Time Machine app. Find and select the files there, then click the toolbar's Action button (a cog) for an option to delete all versions. As they're claimed to carry W97M, they're only a concern if passed to a vulnerable system, not your Mac. Note that macOS's built-in security only checks for and removes malware that affects macOS, not Windows.
Howard Oakley



Check to see if System Restore has been switched off.

WINDOWS
WHAT, NO REGISTRY BACKUPS?

I recently read an article on WindowsReport.com that claims Windows 10 no longer stores Registry backups by default. The article claimed that "[Users] still think that System Restore is backing up their system on a regular basis. In fact, no backup files are stored on your system even though it says, 'The operation completed successfully'." Is this true?
Jack Couper


Windows Features
Turn Windows features on or off
To turn a feature on, select its checkbox. To turn a feature off, clear its checkbox. A filled box means that only part of the feature is turned on.
Microsoft XPS Document Writer
MultiPoint Connector
Print and Document Services
Remote Differential Compression API Support
Services for NFS
Simple TCPIP services (i.e. echo, daytime etc)
SMB 1.0/CIFS File Sharing Support
SMB 1.0/CIFS Automatic Removal
SMB 1.0/CIFS Client
SMB 1.0/CIFS Server
SMB Direct
Telnet Client
OK
Cancel
Enable SMB 1.0 if you can't see all your network devices.

"Experienced system users could use these backups to repair Windows."

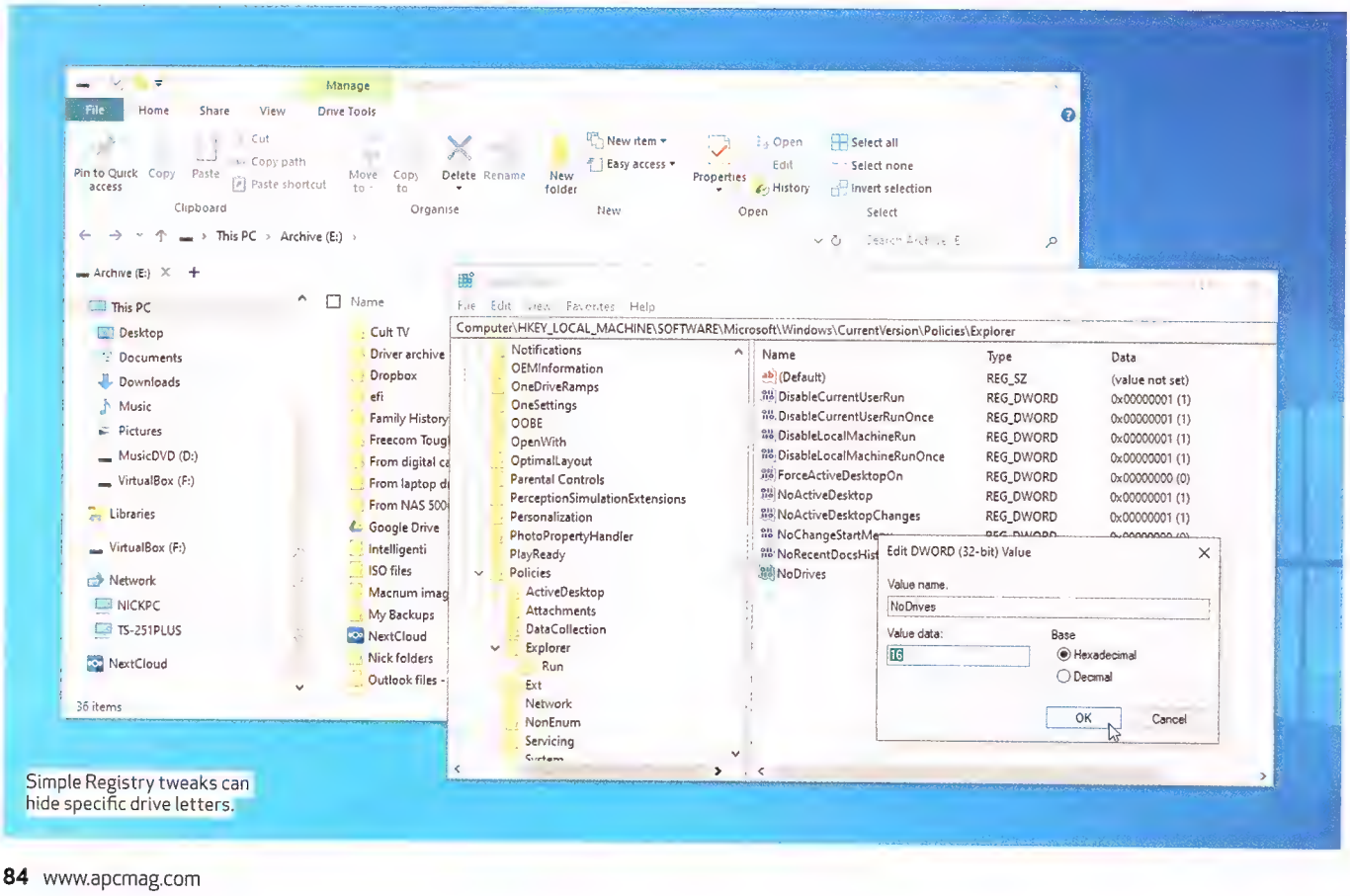
The author of the article has mistakenly conflated the fact Windows 10 switches off System Restore after every major update with a Knowledgebase article admitting that, "The system registry is no longer backed up to the RegBack folder starting with Windows 10 version 1803". This latter article (see **https://support.microsoft.com/kb/4509719** for details and remedial action to take if you're personally affected) referred to an obscure scheduled task that used to run automatically at startup to create backup copies of the Registry files. Experienced system users could use these backups to repair Windows when it wouldn't boot and System Restore points failed. For the average user, this is not a major issue – many people won't even have the scheduled task set up or running, and a better way to protect your system is with a drive-imaging tool such as Macrium Reflect Free (**www.macrium.com/reflectfree.aspx**). More importantly, you should type 'system restore' into the Search box and click 'Create a restore point'. If System Restore is off on all your drives, select your system drive, click Configure and choose 'Turn on system protection' to rectify the problem.
Nick Peers

MEDIA

NO METADATA IN WMP

What's happened to the metadata provider for Windows Media Player? I'm running Windows 7 and I've been unable to pull in any information when ripping CDs since the end of June.
Nicola Leclero

This is because Microsoft has removed its old metadata provider – **fai.music.metaservices.microsoft.com** – which affects Windows Media Player in Windows 7 as well as Windows Media Center in Windows 7, 8 and 8.1. It doesn't, however, affect Windows Media Player in Windows 8, 8.1 or 10. It effectively spells the end of Windows Media Player in Windows 7, but thankfully there are third-party alternatives you can try. We recommend MusicBee (**https://getmusicbee.com**), which gets its metadata from other, universal sources so won't stop working any time soon.
Ian Sleightholm



Simple Registry tweaks can hide specific drive letters.

Use the Edge browser

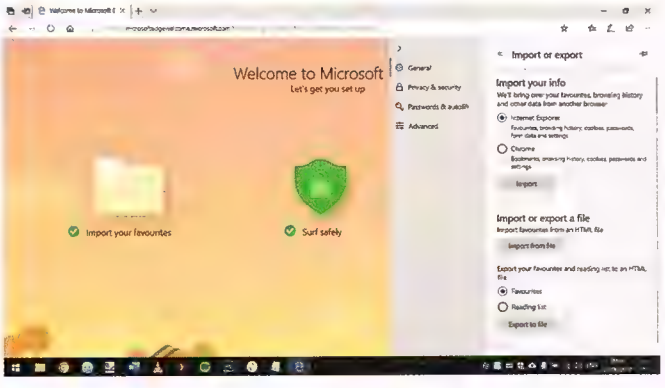
Forget about Internet Explorer, modern Microsoft Edge is a browser that's more than worthy of your attention. Mark Wyciślik-Wilson explains why.

Over the years, Microsoft has found itself on the receiving end of great deal of flak – not least because of its Internet Explorer web browser. But in recent years, the company has switched its focus to the Edge browser, and this has resulted in a huge improvement in both the quality and range of features that are available.

With Edge, Microsoft's web browser is no longer a joke. It no longer plays second fiddle to the likes of Firefox, Chrome and Opera. The number of features available has been massively increased, meaning that opting to use Microsoft's web browser no longer means having to make compromises.

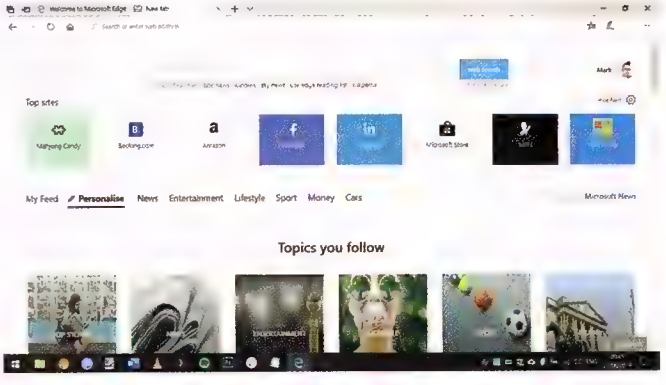
Having gone through a few iterations, Edge is now a highly accomplished browser which is a more than capable alternative to the more popular browsers.

The best of Microsoft Edge



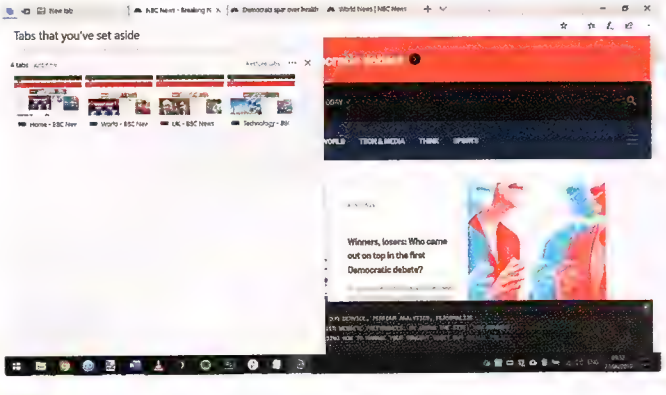
1 EASY TRANSITIONING

If you are moving from another browser to Edge, things are nice and simple. The first time you launch Edge you will be asked if you would like to import your bookmarked sites, saved passwords and other settings. Just hover over the 'Import your favourites' icon, click 'Import now', and use the options to the right to import data. After this, there is also the option of installing extensions to add new features, but we'll return to that later.



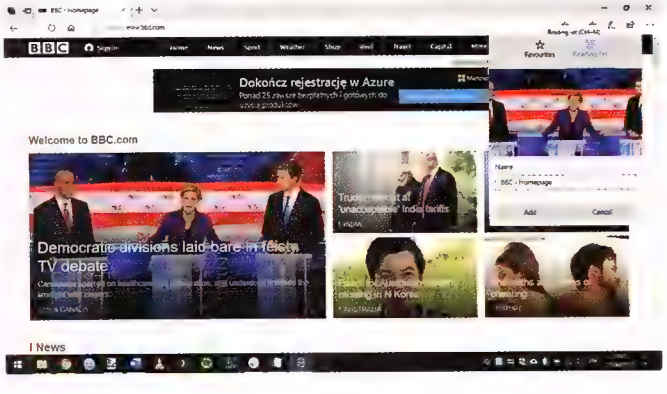
2 CUSTOMISABLE START PAGE

When you open a new tab, Edge can show you not only shortcuts to your most frequently visited sites, but also a personalised news feed. To customise this, open a new tab and click the little gear icon to the upper right. You can then choose whether you want to see 'Top sites and my feed', just 'Top sites', or a blank page. You can customise your news feed by clicking the Personalise link and selecting the topics you're interested in.



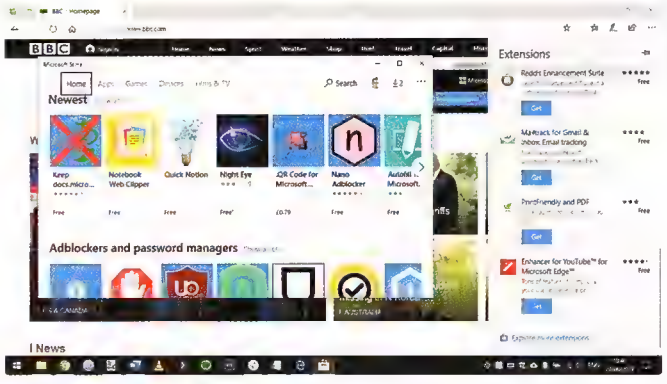
3 SAVE TABS FOR LATER

One of the great things about modern web browsers is being able to have multiple sites open in different tabs – but it's easy to get carried away. Edge has a handy option that lets you set aside a group of tabs so you can return to them later and not have to keep them open all the time. Just click the 'Set these tabs aside' button (the second button in the tab row), and then access them again by clicking the first button, 'See all your tabs'.



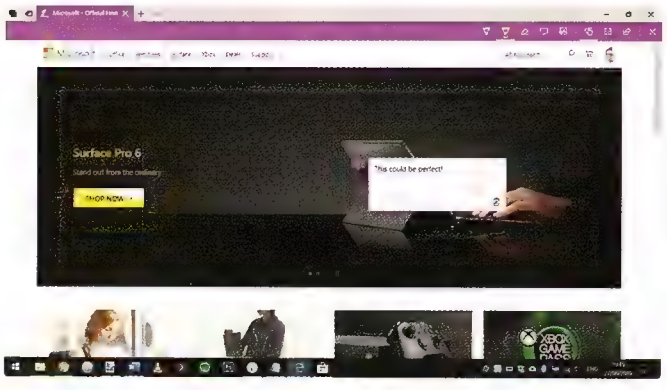
4 READING LIST

You probably know that it's possible to bookmark a site you use a lot, and then access it through Favourites. Edge also includes a similar option called the Reading List, which lets you build up a list of sites you want to refer back to, but might not want to bookmark forever. To add a site to the Reading List, click the star icon to the right of the address bar. Select Reading List, and click Add. Access the Reading List with Ctrl-M.



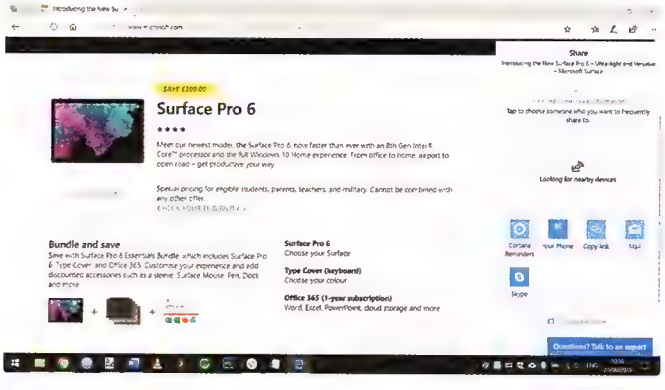
5 BROWSER EXTENSIONS

Edge is a feature-packed browser, but you can add even more options and features by installing extensions. Click the Settings button (three dots) to the upper right and select Extensions. You'll see suggested extensions, and can find more by clicking 'Explore more extensions' at the bottom of the list. This will take you to the Microsoft Store where you can browse from adblockers and note-takers to translation utilities.



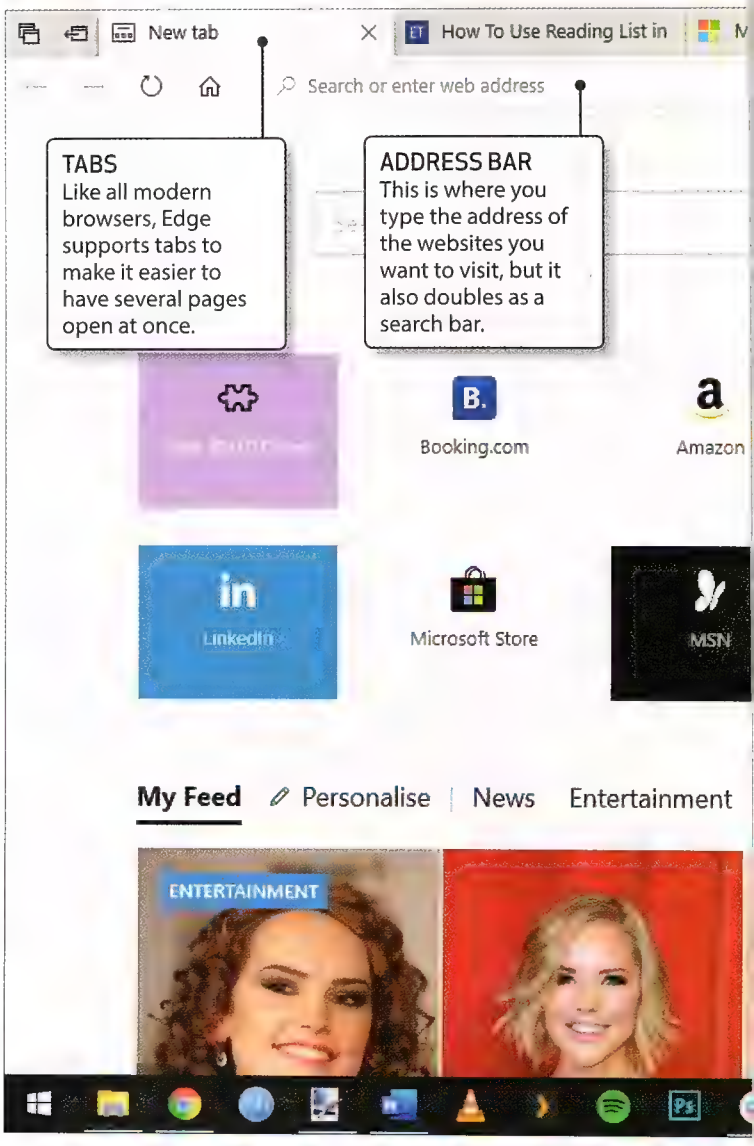
6 HIGHLIGHTING AND NOTES

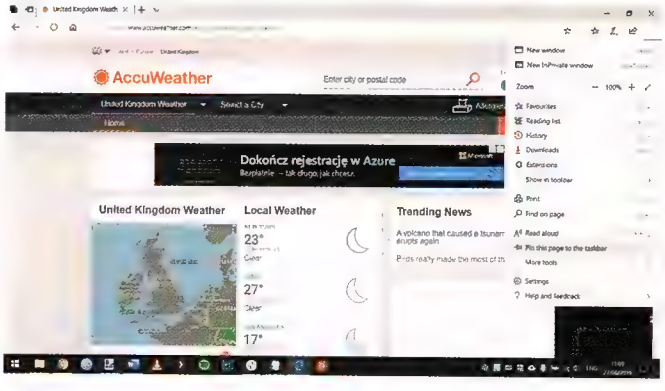
When you visit a website, Edge gives you the option of highlighting sections that you're interested in, as well as adding notes. You can either pressing Ctrl-Shift-M, or click the 'Add notes' button (which looks like a pen) at the top of the Edge window. A new toolbar appears with a highlighter and note-taker. When you've finished with your notes and highlights, click the Save button so you can access them via Favourites.



7 SHARING OPTIONS

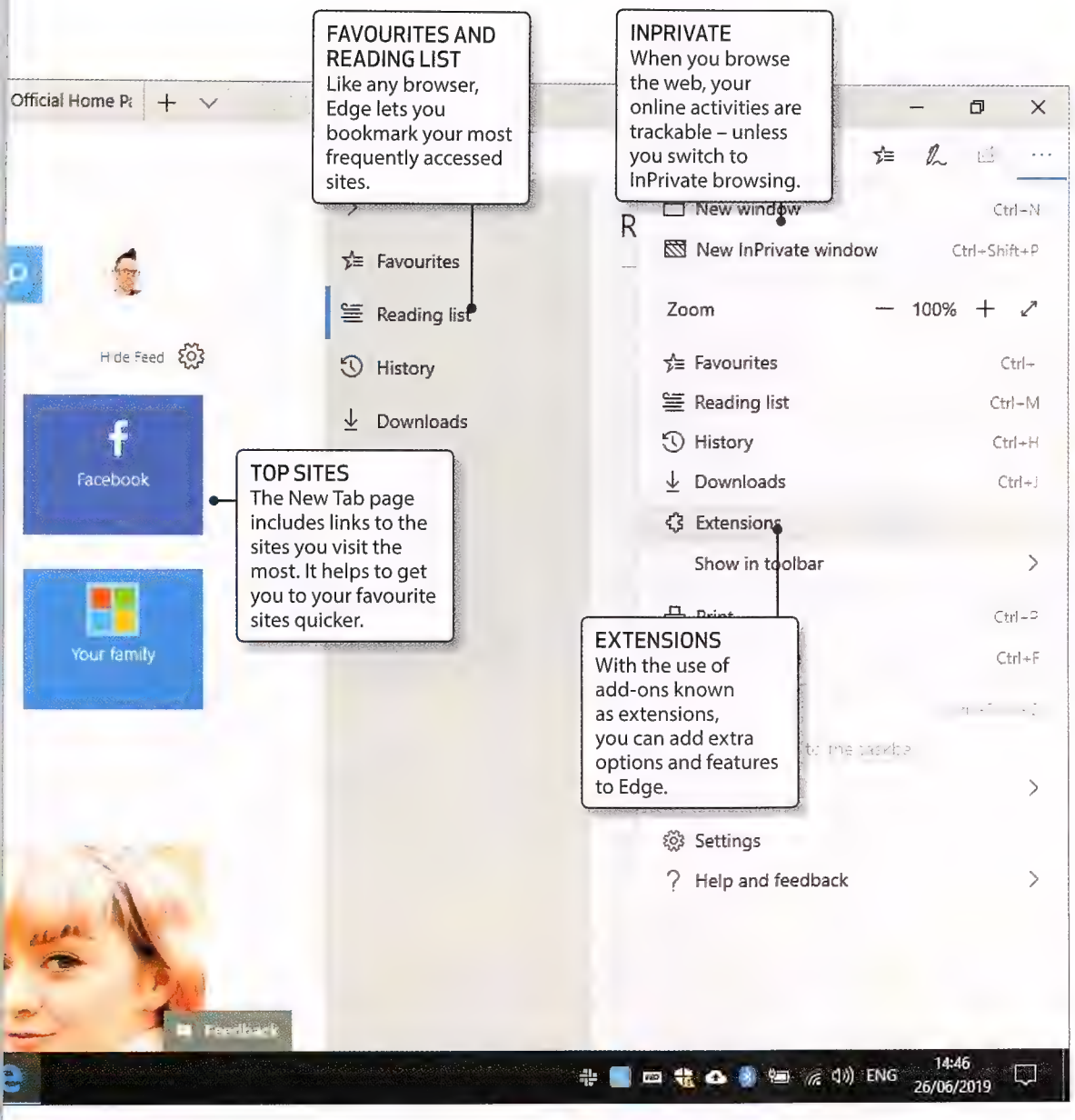
One of the joys of using the internet is sharing the things you find – and Edge makes this very simple. If you would like to share a site, or the notes you add to a site, with someone, just click the 'Share this page' button in the toolbar at the top of Edge (the button next to the three-dot Settings button). You can then choose which of your installed apps you'd like to use to share the link, or just copy the link to the clipboard ready to paste manually.


New tab
How To Use Reading List in
Search or enter web address
TABS
Like all modern browsers, Edge supports tabs to make it easier to have several pages open at once.
ADDRESS BAR
This is where you type the address of the websites you want to visit, but it also doubles as a search bar.
Booking.com
Amazon
LinkedIn
Microsoft Store
MSN
My Feed
Personalise
News
Entertainment
ENTERTAINMENT



8 TAB PINNING

Edge provides a variety of ways to easily access your favourite sites, and one of these if tab pinning. Using this option, you can add a shortcut to a favourite website to the Windows 10 taskbar so it is accessible at all times. Browse to a site you'd like to be able to easily access and click the Settings button followed by 'Pin this page to the taskbar'. You can also pin a tab to the left hand side of Edge by right clicking it and selecting the Pin option.



MARK'S BEST TIP

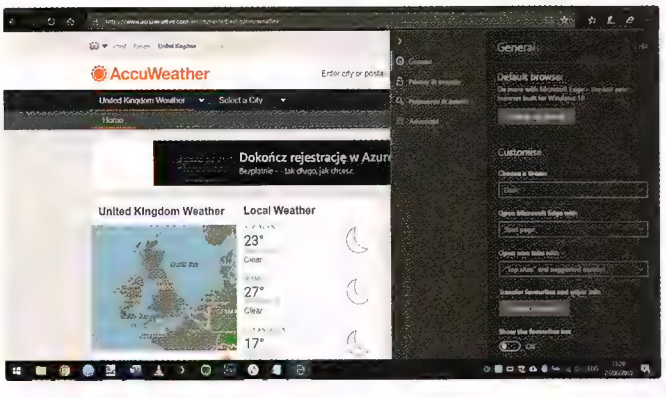
Edge is built into Windows 10. The browser is also available for iOS, Android and even the Xbox One.

JARGON BUSTER!

EXTENSIONS
Small software add-ons that can be used to extend the capabilities of Edge.

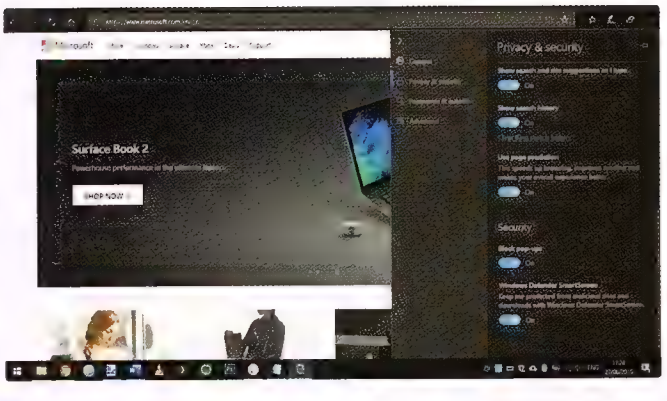
WEB NOTES
Annotations that Edge allows you to add to websites. These could be notes you make about to a page or simple highlights.

INPRIVATE BROWSING
A more secure and private means of browsing which prevents your computer from sharing cookies and other information with the websites you visit.



9 THEMES AND OPTIONS

You can change the look of Edge by adjusting the theme; just as you can use Light and Dark options within Windows 10, so the same themes are available in Edge. If you're looking for a theme that's a little more gentle on the eyes, click the Settings button [...] and select Settings. In the Customise section, you can use the drop-down menu to opt for the Dark theme – which will also help prolong battery life on a laptop.



10 SECURITY FEATURES

Microsoft has designed Edge with security in mind, and the browser is packed with features that help to keep you safe online. Edge will automatically block pop-up windows, as well as preventing you from visiting sites that are known to be dangerous. Should this prevent you from visiting a site you know to be safe, you can head to Settings and temporarily disable the "Block pop-ups" or Windows Defender SmartScreen options. ■

Mastering search on macOS

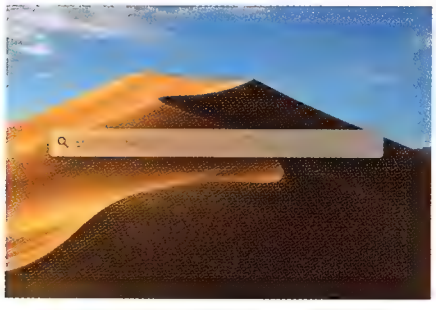
Find files on your Mac with three great ways to search, with Srivats Lakshman.

Don't remember where you saved that important file six months ago? Sometimes you may not even remember the name of a file. If you don't use a filing or naming system, things can be tough. However, with the variety of tools built in to macOS, finding that elusive file can be less stressful.

Siri and Spotlight are simple and straightforward to use, if you know what exactly you are looking for. Entering the file name, format, date (week, month or even the exact date) will bring up all the relevant results. However, the user interface can often be cluttered, and the results inaccurate.

To find exactly what you need, Smart Folders come in handy. Here, your Mac can be automated to group files by multiple parameters, and you can save the results as a 'folder', making it easier to access and view. Even if you know where exactly everything is saved, it's always worth discovering search shortcuts. Read on to find out how to use the search options.

How to find a file with Spotlight



1 INVOKE SPOTLIGHT

To start a Spotlight search, press command-space bar and it will appear on top of any other open apps. If it's in your way for any reason, simply click and drag it to a new location. Spotlight will reappear in that new location when it's next invoked.

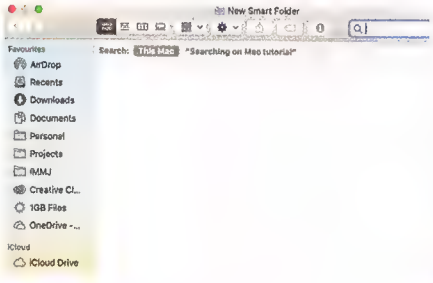
2 SEARCH YOUR MAC

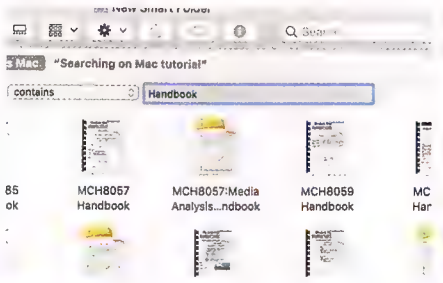
Type in your file name or extension; results appear as you type. Spotlight will present the results in category groups, helping you to locate the file type you're looking for. A preview will also be shown, so you can see the contents.

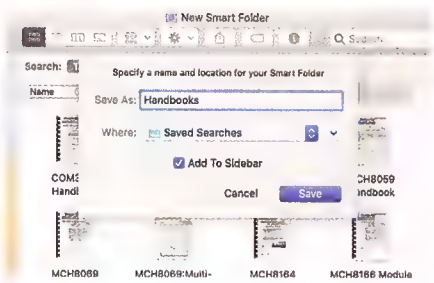
3 OPEN UP OR DIG FURTHER

If you spot your file, double-click to open it. If not, click 'Show all in Finder' at the bottom to open a smart folder with the results. The folder will show the path of the file, so you know where it is. Results are displayed by file type.

How to set up Smart Folders





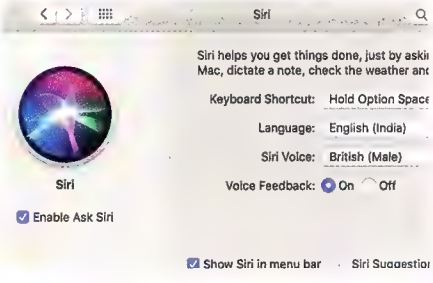


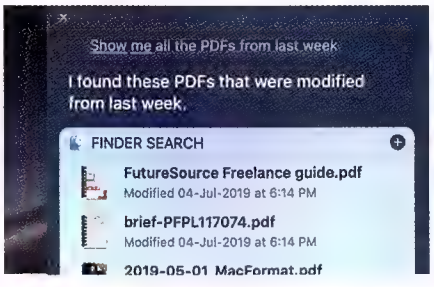
1 SET UP
In Finder, go to File > New Smart Folder. A new search window appears; again, as you type in the top-right search bar, the results appear below. You can opt to look on This Mac or in Shared if you are on a network.

2 DEFINE PARAMETERS
The + icon opens a new bar where you can search by over 50 parameters. Each category comes with its own set of rules, so you can drill down as much as you want. Matching files are listed, and the bottom bar shows the file path.

3 SAVE SEARCH
Double-click a file to open it or press the Space bar to preview it. If you want to save the search, click the Save option. Save the folder to your desired location, and you can access it with a single click next time.

How to search with Siri


Siri
Siri helps you get things done, just by askii
Mac, dictate a note, check the weather anc
Keyboard Shortcut: Hold Option Space
Language: English (India)
Siri Voice: British (Male)
Voice Feedback: On Off
Siri
Enable Ask Siri
Show Siri in menu bar
Siri Suggestior


Show me all the PDFs from last week
I found these PDFs that were modified from last week.
FINDER SEARCH
FutureSource Freelance guide.pdf
Modified 04-Jul-2019 at 6:14 PM
brief-PFPL117074.pdf
Modified 04-Jul-2019 at 6:14 PM
2019-05-01_MacFormat.pdf

1 SET UP SIRI
If Siri is already set up, move to step 2. If not, go to System Preferences > Siri. Tick the checkbox next to 'Enable Ask Siri'. You can specify Siri's language, enable voice feedback, and customise the keyboard shortcut.

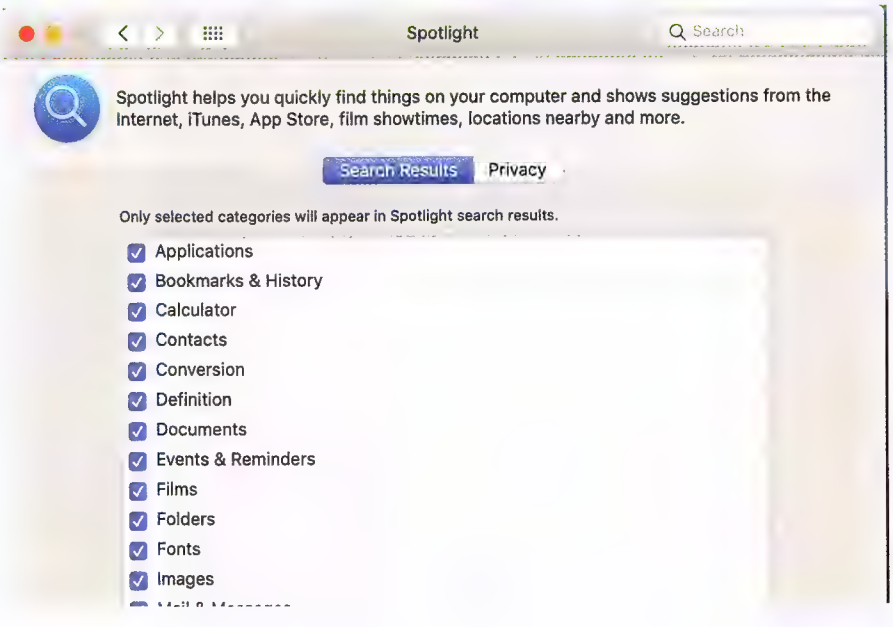
2 ASK SIRI
Invoke Siri and ask it to find a file by format, name or date. You can also add more specific details, such as the name of the sender if the file was sent to you. Siri searches your entire Mac. This allows you to get results from all installed apps.

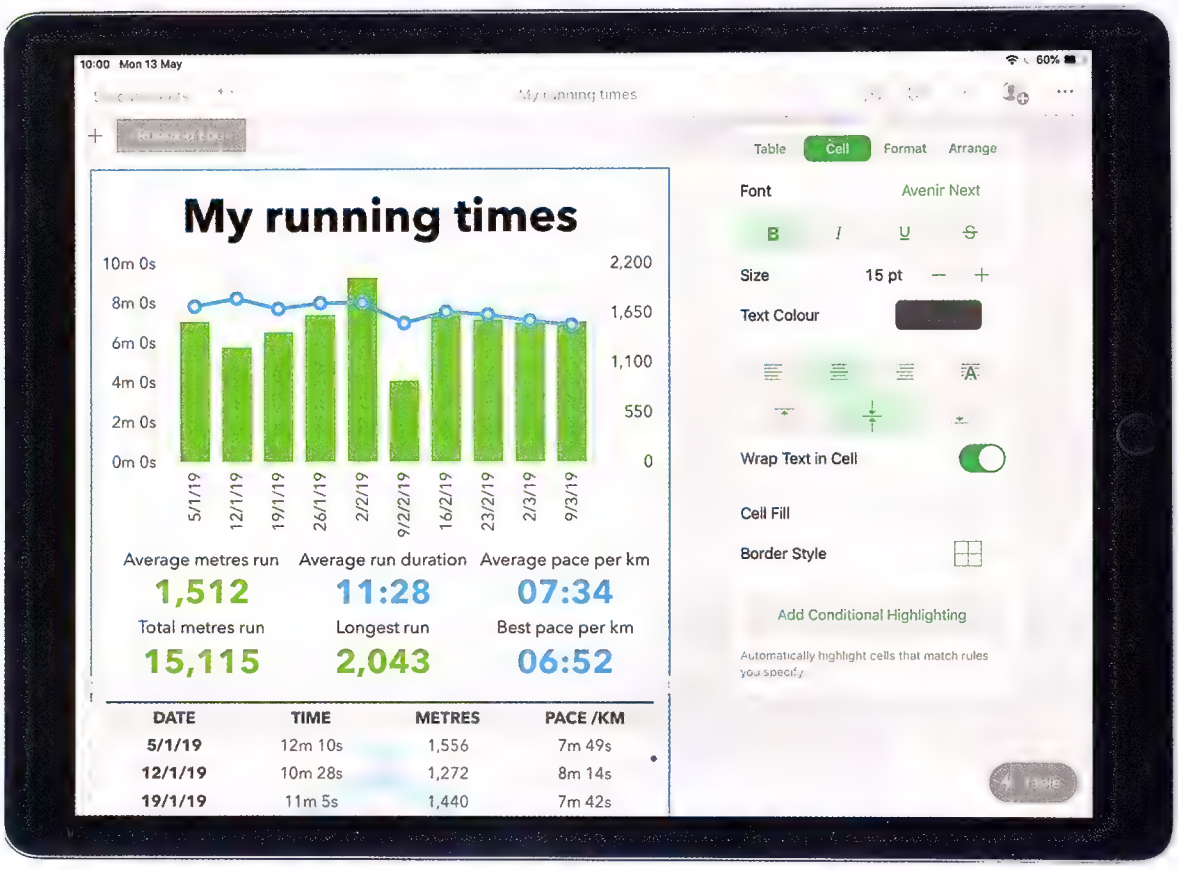
3 SAVE RESULTS
Once Siri locates all the files corresponding to your search, you can pin the results to Notification Centre using the + icon, so you don't have to repeat the process. You can also drag an item out, to create an alias.

Customise Spotlight

Search for what you need, not what you have.

Often, searches can bring up everything from bookmarks, to Safari history and iTunes content. If that's not what you need, go to System Preferences > Spotlight > Search Results to narrow down your search. Here you can select the categories that Siri and Spotlight search upon. Turn off unwanted categories. You can also restrict where Spotlight searches using the Privacy tab. Click the + icon, and select the folder/s you don't want Spotlight to include. Searching networked drives is turned off by default, but can be enabled if required.





Formatting in Numbers

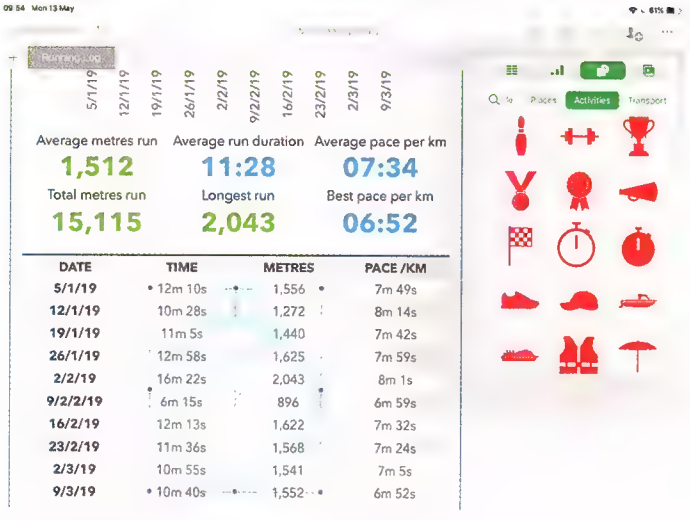
Adam Banks says spreadsheets needn't be dull. Get creative and make the figures pop.

The way Numbers thinks about a spreadsheet is a bit different from the likes of Excel, and makes structuring it more like looking at page of paper. A blank document in Excel is an endless grid of cells into which you can type numbers, formulae and text labels; if you add charts or graphics, they float over the top, like interlopers.

In Numbers, cells only exist within tables. When you pick the Blank template, it starts you off with a table of an arbitrary size, titled 'Table 1'. You can adapt that, or delete it and start from an empty page. The default table is sized to fit across A4, as you'll see if you tap the three dots in the small toolbar at the top right of the screen for the More menu, then pick Print. The cogwheel at the top right then has further print settings, albeit minimal.

CELLS VERSUS TEXT

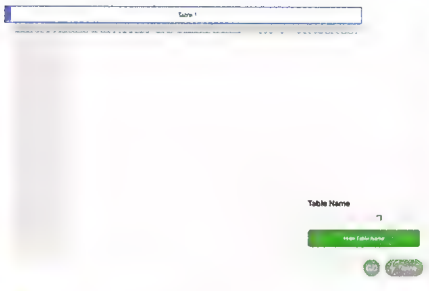
Any content you want to add that uses spreadsheet functionality – references, formulae and so on – must be placed within a table cell. If you then want to title or label something but Numbers for iOS' limited style and position settings make the built-in option unsatisfactory, you can create a table with just one cell, referencing the relevant data. If you just want to type some text, on the other hand, add a dedicated Text box from the Basics set in the shapes available on the third tab under the + icon in the toolbar. This gives you more style options, accessed as always from the brush icon.



A nice touch: insert a graphic (in the same way as the text box in step 6), then under Style from the brush icon, reduce its Opacity before positioning it over the table as a watermark. From Arrange, choose Lock so you don't move it while editing cells later.

"A blank document in Excel is an endless grid of cells into which you can type numbers, formulae and text labels; if you add charts or graphics, they float over the top, like interlopers."

Format and style a sheet

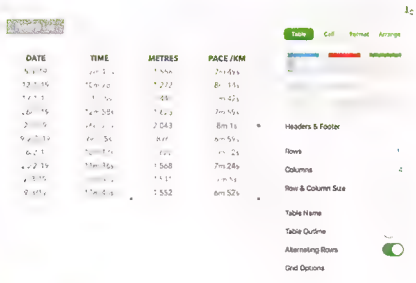


1 MAKE A NEW SHEET

Open Numbers and tap Create Spreadsheet. Pick the Blank template for a page containing a table called 'Table 1'. Tap this title, select Name Actions and tap Hide Table Name. Now enter some data to get started.

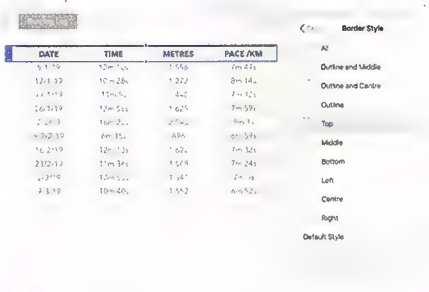
2 FORMAT FIGURES

Tap the number or letter to select a whole row or column, tap the brush icon, and from the Format tab, tap the 'i' beside the appropriate category to format the figures. Turn on Thousands Separator for large numbers.



3 STYLE CELLS

Select some or all of your cells, tap the brush, and on the Cell tab set the text style. Under Table, remove unwanted rows and columns and, in Headers & Footer, turn the rows or columns that should be headers into headers.

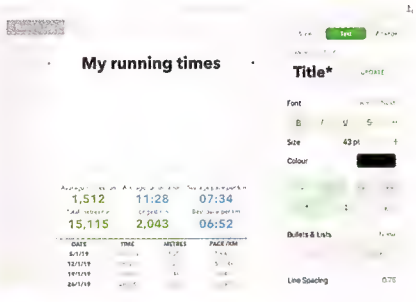


4 CUT THE CLUTTER

Gridlines are often unnecessary. We've turned off Table Outline and some of the Grid Options, instead shading Alternating Rows. But we'll set Cell > Border Style to Top for a thicker rule across the top of the table.

5 ADD ANOTHER TABLE

We want to add summary information, but styled differently. Tap the + sign in the toolbar at the top right, pick a plain table style from the first tab and repeat the steps to enter and style more content.



6 ADD A TITLE BOX

Drag tables by the circle icon at top left to reposition them; automatic guides will help you. We've moved ours to add a title, which we've done as a text box from the Basic shapes under the + icon. The brush icon offers formatting.

7 STYLE A CHART

We've added a chart. Use the brush icon options (trial and error works wonders here) to apply just enough lines and labels for clarity, and set Chart > Chart Font to a plain typeface as big as will fit comfortably.

8 FIT LABELS VERTICALLY

Our run dates won't fit across the bottom, so only half of them are showing up. A neat way to fix this is to set X-Axis > Label Angle to one of the Vertical options. You may need to make more room below your chart though.

9 ADD A BORDER

Table Outlines and Border Styles apply to individual tables. For a border around your whole layout, add a square from the + icon, use its handles to size it, and from the brush icon style it with no fill and a border.

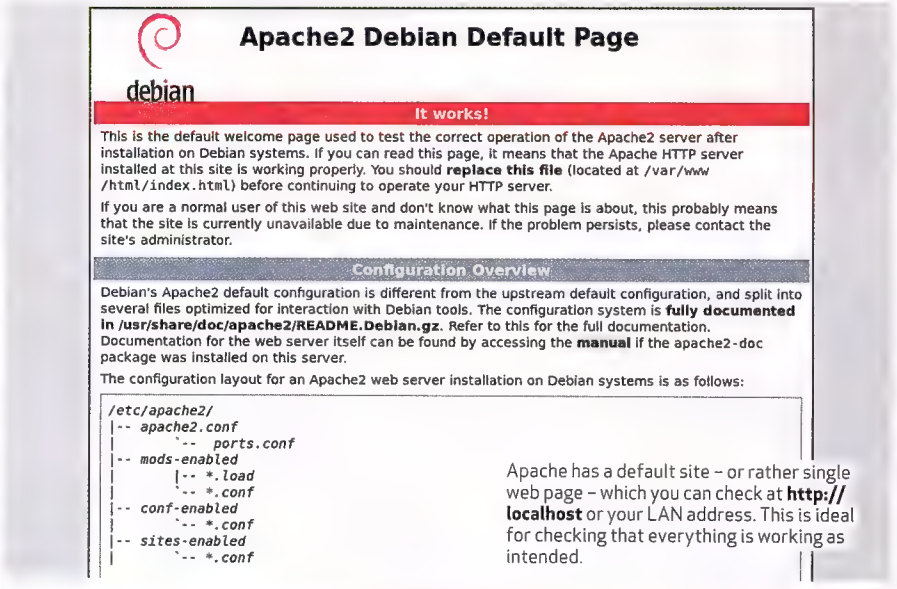
Set up a production-ready web server

Mark Chisholm guides you through the process of installing and configuring your own web server.

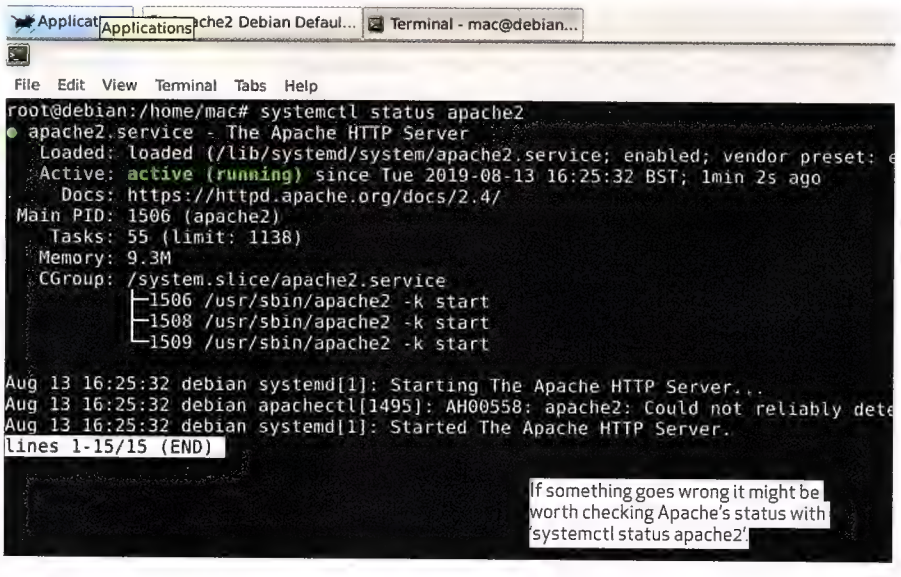
Firstly, what do we mean by "production-ready"? We're taking the assumption that you're setting up a server with some critical data, where wasted time means wasted money if it were to collapse or otherwise break down. Uptime is paramount to a fully functioning web server.

Of course, there are a lot of different types of Linux-based operating systems to choose from, so what would make a good base for a web server? Well, we need it to be rock-solid stable, with few breakages (and preferably none at all) during a package upgrade or kernel installation.

Debian or Ubuntu are both good choices for this, and while there isn't anything actually stopping you using Arch or Gentoo, they're probably best avoided – we're looking to make it rock-solid, rather than anything like a Jenga tower. Statistics show us that over 80 per cent of websites and web applications are powered by open-source web servers. With stability being one of Debian's main points, it's easy to see why we've chosen to use it for this tutorial.


Apache2 Debian Default Page
debian
It works!
This is the default welcome page used to test the correct operation of the Apache2 server after installation on Debian systems. If you can read this page, it means that the Apache HTTP server installed at this site is working properly. You should replace this file (located at /var/www/html/index.html) before continuing to operate your HTTP server.
If you are a normal user of this web site and don't know what this page is about, this probably means that the site is currently unavailable due to maintenance. If the problem persists, please contact the site's administrator.
Configuration Overview
Debian's Apache2 default configuration is different from the upstream default configuration, and split into several files optimized for interaction with Debian tools. The configuration system is fully documented in /usr/share/doc/apache2/README.Debian.gz. Refer to this for the full documentation. Documentation for the web server itself can be found by accessing the manual if the apache2-doc package was installed on this server.
The configuration layout for an Apache2 web server installation on Debian systems is as follows:
/etc/apache2/
|-- apache2.conf
| `-- ports.conf
|-- mods-enabled
| |-- *.load
| `-- *.conf
|-- conf-enabled
| `-- *.conf
|-- sites-enabled
| `-- *.conf

Apache has a default site – or rather single web page – which you can check at **http://localhost** or your LAN address. This is ideal for checking that everything is working as intended.


Applications
Terminal - mac@debian...
File Edit View Terminal Tabs Help
root@debian:/home/mac# systemctl status apache2
apache2.service - The Apache HTTP Server
Loaded: loaded (/lib/systemd/system/apache2.service; enabled; vendor preset:
Active: active (running) since Tue 2019-08-13 16:25:32 BST; 1min 2s ago
Docs: https://httpd.apache.org/docs/2.4/
Main PID: 1506 (apache2)
Tasks: 55 (limit: 1138)
Memory: 9.3M
CGroup: /system.slice/apache2.service
├─1506 /usr/sbin/apache2 -k start
├─1508 /usr/sbin/apache2 -k start
└─1509 /usr/sbin/apache2 -k start
Aug 13 16:25:32 debian systemd[1]: Starting The Apache HTTP Server...
Aug 13 16:25:32 debian apachectl[1495]: AH00558: apache2: Could not reliably dete
Aug 13 16:25:32 debian systemd[1]: Started The Apache HTTP Server.
lines 1-15/15 (END)

If something goes wrong it might be worth checking Apache's status with 'systemctl status apache2'.

SERVER CHOICE

You may have heard the term 'LAMP stack' when referring to web servers; this simply means a collection of software including Linux, Apache (the HTTP server itself), MySQL (for database management) and a 'P'rogramming language such as PHP. An alternative is a LEMP stack, where Apache is replaced by the Nginx server. (Developers love to make things more complicated than necessary, so "Nginx" is pronounced as "Engine x", hence the E.) Good old Apache might be a bit long in the tooth, but it's still more than capable of powering high-traffic websites easily. The Apache HTTP server project aims to be a modern, open source web server for all operating systems – even Windows. It's designed to be powerful and flexible, working in environments that require different feature sets.

Apache 2.0 introduced multi-processing modules – MPMs – that are responsible for binding to the network ports and accepting requests. To a user they appear much like the other Apache httpd modules you may be familiar with. The only difference is that one, and only one, MPM can be loaded onto the server at any time. This results in a secure, efficient and extensible framework that complies with all HTTP standards.

Apache is still arguably the de facto web server if you intend to host multiple sites on one server. This is where Apache maintains its edge, but it can still lose out in performance terms to web servers such as Nginx. While Nginx is also an open source web server, it offers an Nginx+ option with software-based load balancing, a content cache and even an API gateway. The catch is that you pay per instance for this option.

There are other alternatives such as lighttpd, which is fully open source under a revised BSD licence. Its developers are quite modest in their own description of the web server, saying it powers just "several" of the websites in existence today. However,

it's still actively updated and maintained, and its feature set is all about serving pages quickly. As of January 2019 the Apache webserver still dominates in most metrics, but Nginx is leading the way in terms of growth. For the sake of trying to simplify an already fairly complex undertaking, we'll be using Apache.

Now let's look at the networking side of things. Imagine walking up to a restaurant for your reservation where a doorman decides if you're getting in or not. This is roughly equivalent to a HTTP request to the firewall determining if it will pass the traffic. Most web servers are configured to handle HTTP requests on port 80 of a firewall, and HTTPS on 443. If the port isn't open you won't be able to complete the HTTP request which you're trying to send to the server, because it's blocked at the firewall.

Our example restaurant is one of those fancy ones where you have to report to the front desk to be allocated a seat after giving them your name. So you tell them the name of the site you want to access and they sit you down there.

Imagine each of those seats in that restaurant is a website; the person at the front desk wouldn't quite know where to put you to if you didn't have the name of the site in the HTTP request. This is important because of the way in which Apache – and indeed a lot of web servers worth their salt – can host multiple websites on one server. It's called virtual hosting, and creating virtual hosts is an easy and a really cheap way of hosting more than one site on the same server.

TABLE FOR TWO, PLEASE

You may be wondering about how and where you're going to host the server –and there are a few options for this. While you can do this on your local area network (LAN) at home as a way of accessing files, not all ISPs will allow you to open up port 80 to start serving content through the internet. They might allow it in the firewall of their routers, but if you check the fine print of your agreement, it might well say otherwise.

Another issue with hosting your fancy server at home is the availability or otherwise of a static IP address. You'll need one of these in order to point the domain name to resolve to.

DNS servers work by taking a domain name and seeing which IP address it goes to. If you open a terminal and try pinging a website, it will expose that IP address as well as the domain name. So if you tell a DNS server to always point to 192.168.0.1 and your ISP allocates you a new dynamic IP address – as most do –the DNS server is still going to be pointing towards the old address. Another issue with hosting a web server at home is that it needs to be powered on 24/7 – if you want people to be able to access content 24/7.

A virtual private server (VPS) is a good way of getting a server up and running and there are a lot of cheap options for renting one of these. Depending on your use case, though, be sure to assess if you need a hexa-core VPS or if the little single-core, 512MB RAM option is sufficient. A lot of business owners like the idea that a VPS can grow with their business really easily – something to bear in mind if they become your clients one day.

There are managed and unmanaged options for a VPS. A managed option means there is some support, while the unmanaged option means you're running as root, trying to keep it all together yourself. There are actually shared hosting options as well, but these usually don't come with a lot of fine-tuning control – and at *APC* we like working on servers under the bonnet, with a crowbar if the need arises.

SOUP OF THE DAY

For the 'M' of our LAMP stack, there are two notable contenders. MySQL is known to be used by the likes of Facebook, GitHub and YouTube, to name just a few. Alternatively there's MariaDB, a fork of MySQL, which is used by some giants in the tech industry such as Redhat, SUSE and Ubuntu/ Canonical. MySQL uses caching sha2 passwords as its authentication plug-in which greatly improves security.

The P in the lamp stack can either stand for PHP, Perl or Python. Of course you can have more than one installed, and indeed you might need to for everything to work as intended, since Perl and Python can install themselves as dependencies of other packages.

Some individuals vehemently dislike PHP; it gets a lot of hate, and can be the butt of a lot of jokes in the sysadmin world, with some even questioning its

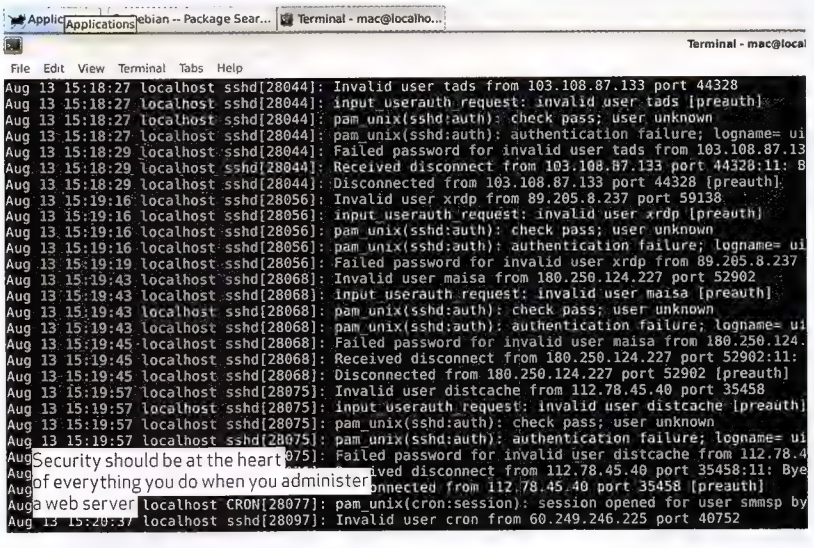
Keep a check on your log files

With a publicly available web server to administer, it's now more important than ever to keep a check on log files for any suspicious activity.

One such file is auth.log, which checks for any failed login attempts to the server itself – likely using an SSH connection in an attempt to break into the server.

You might be thinking that nobody would bother trying to take over a small server with nothing going on, but you'd be wrong. A lot of these attacks are automated, so rather than being a person trying to break into the server, it's a program looking for vulnerable machines to take over. These programs often just take over a server, install some other pieces of software or malware, then move on to the next target – possibly using your server to launch its attacks.

You should also look into installing fail2ban, which is an intrusion-prevention software framework designed to permanently lock out any would-be attackers from a certain IP address. It works by scanning the Apache error log for anything it deems malicious, such as too many login attempts. Once it has found something it will update the firewall rules to reject any data packets from a certain IP address for a specified time.


Applications
Terminal - mac@localho...
Terminal - mac@local
File Edit View Terminal Tabs Help
Aug 13 15:18:27 localhost sshd[28044]: Invalid user tads from 103.108.87.133 port 44328
Aug 13 15:18:27 localhost sshd[28044]: input_userauth_request: invalid user tads [preauth]
Aug 13 15:18:27 localhost sshd[28044]: pam_unix(sshd:auth): check pass; user unknown
Aug 13 15:18:27 localhost sshd[28044]: pam_unix(sshd:auth): authentication failure; logname= ui
Aug 13 15:18:29 localhost sshd[28044]: Failed password for invalid user tads from 103.108.87.13
Aug 13 15:18:29 localhost sshd[28044]: Received disconnect from 103.108.87.133 port 44328:11: B
Aug 13 15:18:29 localhost sshd[28044]: Disconnected from 103.108.87.133 port 44328 [preauth]
Aug 13 15:19:16 localhost sshd[28056]: Invalid user xrdp from 89.205.8.237 port 59138
Aug 13 15:19:16 localhost sshd[28056]: input_userauth_request: invalid user xrdp [preauth]
Aug 13 15:19:16 localhost sshd[28056]: pam_unix(sshd:auth): check pass; user unknown
Aug 13 15:19:16 localhost sshd[28056]: pam_unix(sshd:auth): authentication failure; logname= ui
Aug 13 15:19:19 localhost sshd[28056]: Failed password for invalid user xrdp from 89.205.8.237
Aug 13 15:19:43 localhost sshd[28068]: Invalid user maisa from 180.250.124.227 port 52902
Aug 13 15:19:43 localhost sshd[28068]: input_userauth_request: invalid user maisa [preauth]
Aug 13 15:19:43 localhost sshd[28068]: pam_unix(sshd:auth): check pass; user unknown
Aug 13 15:19:43 localhost sshd[28068]: pam_unix(sshd:auth): authentication failure; logname= ui
Aug 13 15:19:45 localhost sshd[28068]: Failed password for invalid user maisa from 180.250.124.
Aug 13 15:19:45 localhost sshd[28068]: Received disconnect from 180.250.124.227 port 52902:11:
Aug 13 15:19:45 localhost sshd[28068]: Disconnected from 180.250.124.227 port 52902 [preauth]
Aug 13 15:19:57 localhost sshd[28075]: Invalid user distcache from 112.78.45.40 port 35458
Aug 13 15:19:57 localhost sshd[28075]: input_userauth_request: invalid user distcache [preauth]
Aug 13 15:19:57 localhost sshd[28075]: pam_unix(sshd:auth): check pass; user unknown
Aug 13 15:19:57 localhost sshd[28075]: pam_unix(sshd:auth): authentication failure; logname= ui
Aug 13 15:19:59 localhost sshd[28075]: Failed password for invalid user distcache from 112.78.4
Aug 13 15:19:59 localhost sshd[28075]: Received disconnect from 112.78.45.40 port 35458:11: Bye
Aug 13 15:19:59 localhost sshd[28075]: Disconnected from 112.78.45.40 port 35458 [preauth]
Aug 13 15:20:01 localhost CRON[28077]: pam_unix(cron:session): session opened for user smmsp by
Aug 13 15:20:37 localhost sshd[28097]: Invalid user cron from 60.249.246.225 port 40752

Security should be at the heart of everything you do when you administer a web server

relevancy and value in 2019. To this we would respond that you can still find COBOL being used in certain use cases – that's a language developed in 1959. PHP is still actively developed and maintained in 2019, and as of version 7 it's a lot faster while still being simple and syntax-rich. It still powers large and complex websites such as Facebook.

Enough talking – it's time to start building this server. In order to begin installing the required software it's a good idea to double-check that our Debian installation is up to date, which we can do with:

```
sudo apt-get update && apt-get upgrade
```

Next we'll install the MySQL server:

```
sudo apt-get install mysql-server mysql-client
```

The installation process will ask you to enter a root password for the MySQL database. Use something strong and different from all the other passwords you use; remember this is a server that you're exposing to the entirety of the internet, and it's all front-facing and publicly accessible.

Next we'll be installing Apache, but again remember that we're approaching this from a 'how-to' perspective. You might have your own needs that would really benefit from Nginx software load-balancing – it's your server and you can choose what gets installed. We're choosing Apache not because of any bias towards it, but it makes things far easier to set up – either in a real VPS or a virtual machine instance in VirtualBox. Apache is also really well-documented for Debian- and Ubuntu-based installs, so should also be approachable for beginners to Linux in general.

With that said let's install Apache:

```
sudo apt-get install apache2 apache2-doc
```

Now you can configure user directories for Apache to use; again, it's up to you if you choose to do this. First we need to enable the 'userdir' module; with a Debian-based distribution this as easy as this:

```
sudo a2enmod userdir
```

From there we then need to make sure that the `/etc /apache2/mods-enabled/userdir.conf` looks like:

```
<IfModule mod_userdir.c>
  UserDir public_html
  UserDir disabled root
  <Directory /home/*/public_html>
  AllowOverride All
  Options MultiViews Indexes SymLinksIfOwnerMatch
  <Limit GET POST OPTIONS>
  Require all granted
  </Limit>
  <LimitExcept GET POST OPTIONS>
  Require all denied
  </LimitExcept>
  </Directory>
  </IfModule>
```

For the next step it's important to create the directory as your user account – don't create it as root or you will run into permission errors later on.

```
$ mkdir /home / user/ public_html
```

Next we need to change the group of the newly created directory so that Apache can access it. For this we need to be root or use `sudo` with the command:

```
chgrp www-data /home / user/ public_html
service apache2 restart
```

You might get a 'Forbidden' error when trying to access the `home` folder through Apache. In that case you need to verify if `home/user/` has the following permissions:

```
drwxr-xr-x
```

If they don't, enter the following command as root:

```
# chmod 755 /home/user
```

Once that's done we can then begin installing PHP with the command:

```
sudo apt-get install php php-mysql
```

Once PHP is installed we can double-check it actually works by entering the following commands:

```
sudo nano /var/www/html/test.php
<?php phpinfo(); ?>
```

Press Ctrl-X followed by Y to save it. If you then try accessing `http://<SERVERIP>/test.php`, you should see some info about your server. Once you've verified that PHP is installed and working, it's a good idea to delete this file from the server – it just serves information about your server to anyone who accesses it. Information like that is on a need-to-know basis, as it could potentially expose vulnerable information that could be exploited by those with less moral intentions.

WHO HAD THE STARTER?

Now that you have a working web server it's time to actually start serving content. We'll use WordPress for that since it's easy to install and configure. WordPress advertises itself as a blogging platform, but even though it's perfect for blogging it's also perfect for serving static content, while being

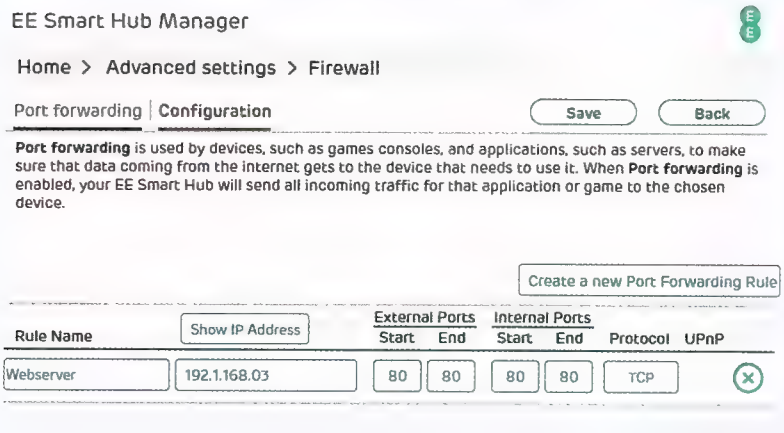
Forward your ports

It's worth mentioning that if you do opt to run this server from home, you'll need to forward any incoming connections to the appropriate web server.

Let's say someone tries to connect to your IP via a web browser: without port 80 being open, all their data packets will get dropped at the firewall and they won't be able to connect to you.

To fix this you need to know the IP address of your server – the physical device, that is. If it's on the LAN it probably has a 192.168.0.xx address. Next you'll need to navigate to the default gateway on your browser – it's commonly 192.168.0.1, but other variations exist, depending on the setup and the router. Log in as admin and look around; there should be a section that enables you to forward ports or configure the networking settings of the router.

Once you find it you'll need to tell the router firewall that any incoming data packets trying to send HTTP requests should go to the server – that's where you enter the server IP on the LAN. When it's properly configured, everyone entering your IP address will be able to view the content of the server.


EE Smart Hub Manager
Home > Advanced settings > Firewall
Port forwarding | Configuration
Save
Back
Port forwarding is used by devices, such as games consoles, and applications, such as servers, to make sure that data coming from the internet gets to the device that needs to use it. When Port forwarding is enabled, your EE Smart Hub will send all incoming traffic for that application or game to the chosen device.
Create a new Port Forwarding Rule
Rule Name
Show IP Address
External Ports Start End
Internal Ports Start End
Protocol
UPnP
Webserver
192.1.168.03
80 80 80 80
TCP

You'll need to forward any incoming data packets straight to your server.

user-friendly and making it easy to update a site – which is why it's so widely used in the industry.

To begin the installation we need to enter the following commands:

```
sudo apt-get install
wordpress curl
```

Once WordPress is installed it's a good idea to make sure that we have a secure MySQL installation to use for it. We do that with:

```
mysql_secure_installation
```

Once that's done we can begin creating a site.

```
nano etc / apache2/ sites-
available / wp.conf
```

And enter this

```
<VirtualHost *:80>
ServerName myblog.example.
com
ServerAdmin webmaster@
example.com
DocumentRoot /usr/share/
wordpress
Alias /wp-content /var/lib/
wordpress/wp-content
<Directory /usr/share/
wordpress>
Options FollowSymLinks
AllowOverride Limit Options
FileInfo
DirectoryIndex index.php
Require all granted
</Directory>
<Directory /var/lib/
wordpress/wp-content>
Options FollowSymLinks
Require all granted
</Directory>
ErrorLog ${APACHE_LOG_DIR}/
error.log
CustomLog ${APACHE_LOG_DIR}/
access.log combined
</VirtualHost>
```

Just remember to replace `example.com` with your own domain name or server IP address. Once that's done you can disable the default Apache site and enable the WordPress site with the following command:

```
a2dissite 000-default
a2ensite wp
```

Finally we're ready to reload the web server via:

```
sudo systemctl reload
apache2
```

Now we need to create and configure the `conf` file for WordPress by entering the command:

```
nano /etc/WordPress/config-
myblog.example.com.php
```

Then we need to add the following to the file:

```
<?php
define('DB_NAME',
'wordpress');
define('DB_USER',
'wordpress');
define('DB_PASSWORD',
'password');
define('DB_HOST',
'localhost');
define('WP_CONTENT_DIR', '/
var/lib/wordpress/wp-
content');
?>
```

Needless to say, replace `password` with a suitably secure password. Next we create a file that holds the database creation instructions:

```
nano ~/wp.sql
CREATE DATABASE wordpress;
GRANT SELECT,INSERT,UPDATE,D
ELETE,CREATE,DROP,ALTER
ON wordpress.*
TO wordpress@localhost
IDENTIFIED BY 'password';
FLUSH PRIVILEGES;
```

Once that's done we'll be able to log in to WordPress with the credentials you created earlier and access the blog. Remember that even though it defaults to being a blogging platform, it's better described as a content management system, or CMS. It has even been described as a factory that creates webpages. WordPress is based on PHP and MySQL and features many free templates which you can use to design your site as you see fit. There a lot of extra add-ons you can install as well, such as woo-commerce for shopping and setting up an e-commerce site. ■

IP freely

So your computer is (hopefully) connected to the internet either through a Wi-Fi connection or an ethernet cable.

When you go online your http header requests have to go to the correct places and IP addresses play a significant role in making sure that happens.

To allow for these connections to happen the networking software is programmed to follow a list of rules and standards and of course protocols. One such protocol, the IP (Internet Protocol); is responsible for addressing and delivering the requests precisely. It also uses an electronic return address to all activities.

The address it uses to send the data packets back is the IP address assigned to your network. Think of it like a return to sender address.

IP addresses cover two things in a computer network, one of them is host and network interface detection and the other is location addressing. Network addresses differ as they serve as an identifier for hosts on a given network, they are mostly used as unique identifiers but some networks allow for hosts to share the same address as well.

Internet Protocol version four (IPv4) defines IP addresses as 32-bit numbers, that pre-dates the internet as we know it today. It dates back to 1980, described by the Internet Engineering Task Force in RFC 790 an update was released in September 1981 in RFC 791.

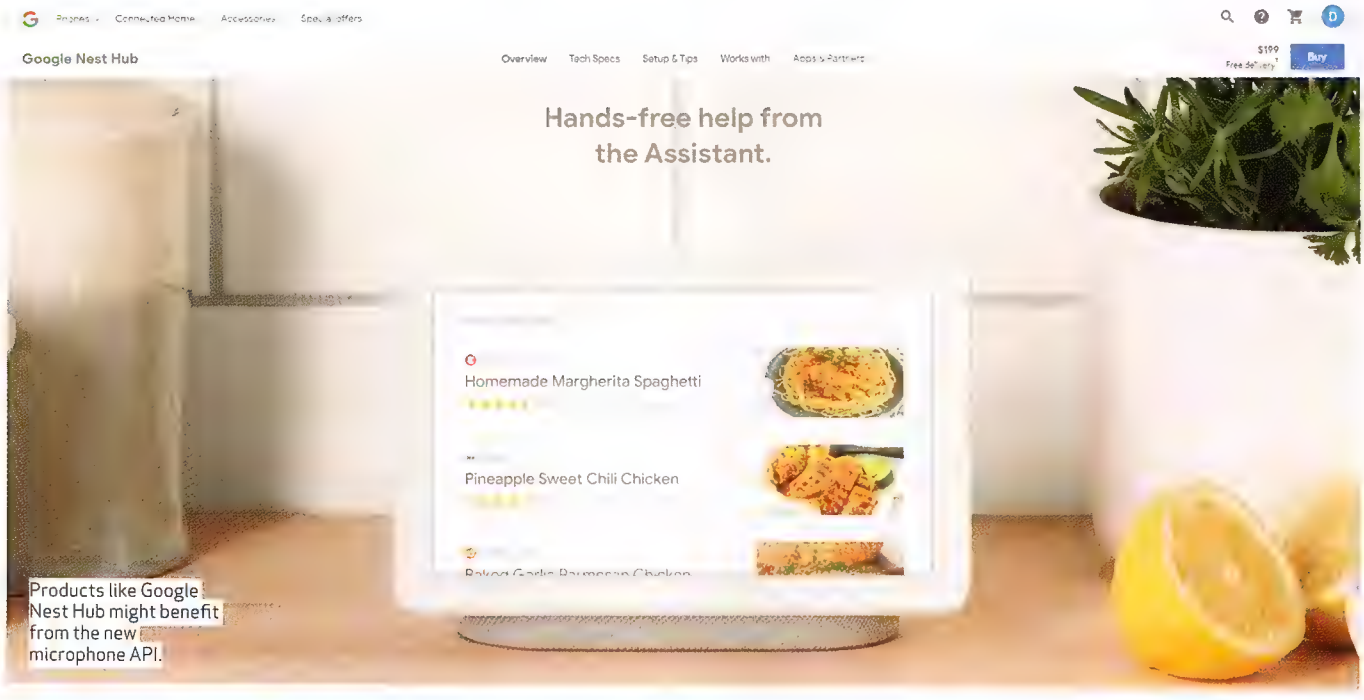
Needless to say the internet has grown exponentially since then and that has led to a rapid depletion of IP addresses. A newer version, Internet Protocol Version six was developed in 1995 and has been standardised since December 1998.

The entire IP address space is managed by five regional internet registries and the internet assigned numbers authority (IANA) each organisation is responsible for designated locales and assigning IP addresses to local internet registries such as your ISP.

PHP Version 7.3.4-2

System	Linux debian 4.19.0-5-amd64 #1 SMP Debian 4.19.37-5 (2019-06-19) x86_64
Build Date	Apr 13 2019 19:05:48
Server API	Apache 2.0 Handler
Virtual Directory Support	disabled
Configuration File (php.ini) Path	/etc/php/7.3/apache2
Loaded Configuration File	/etc/php/7.3/apache2/php.ini
Scan this dir for additional .ini files	/etc/php/7.3/apache2/conf.d
Additional .ini files parsed	/etc/php/7.3/apache2/conf.d/10-opcache.ini, /etc/php/7.3/apache2/conf.d/10-pdo.ini, /etc/php/7.3/apache2/conf.d/20-calendar.ini, /etc/php/7.3/apache2/conf.d/20-ctype.ini, /etc/php/7.3/apache2/conf.d/20-exif.ini, /etc/php/7.3/apache2/conf.d/20-fileinfo.ini, /etc/php/7.3/apache2/conf.d/20-ftp.ini, /etc/php/7.3/apache2/conf.d/20-gettext.ini, /etc/php/7.3/apache2/conf.d/20-iconv.ini, /etc/php/7.3/apache2/conf.d/20-json.ini, /etc/php/7.3/apache2/conf.d/20-phar.ini, /etc/php/7.3/apache2/conf.d/20-posix.ini, /etc/php/7.3/apache2/conf.d/20-readline.ini, /etc/php/7.3/apache2/conf.d/20-sysvmsg.ini, /etc/php/7.3/apache2/conf.d/20-shmop.ini, /etc/php/7.3/apache2/conf.d/20-sockets.ini, /etc/php/7.3/apache2/conf.d/20-sysvsem.ini, /etc/php/7.3/apache2/conf.d/20-sysvshm.ini, /etc/php/7.3/apache2/conf.d/20-tokenizer.ini
PHP API	20180731
PHP Extension	20180731
Zend Extension	320180731

PHP also has a good way of checking it's installed and to display info about the system. Remember not to expose this info about your system to anyone with less savoury intentions.

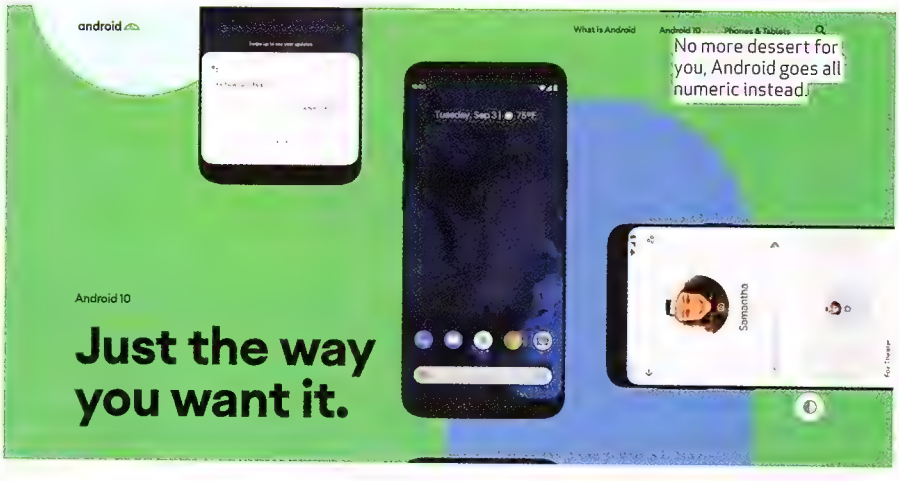


Products like Google Nest Hub might benefit from the new microphone API.

The Android 10 hardware revolution

The latest Android release comes with plenty of focus on hardware. In fact, one of the changes will end up staring you in the face. Darren Yates explains.

Well, that's the end of an era. Since the arrival of version 1.5 ten years ago, Android has managed to capture child-like enthusiasm for each new release with a new scrummy confectionary codename. But, presumably not finding anything decent beginning with 'Q' (quinces have always been under-rated – and yes, they're a fruit), Google has given us a much more grown-up 'Android 10'. While there's been plenty of talk about new dark themes and other new features, like gesture navigation, we're taking a look at the new OS from a hardware perspective – and what you'll see coming in your next phone.

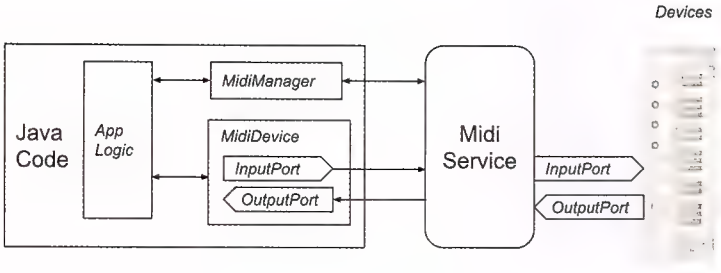


BREAKING THE SPEED LIMIT

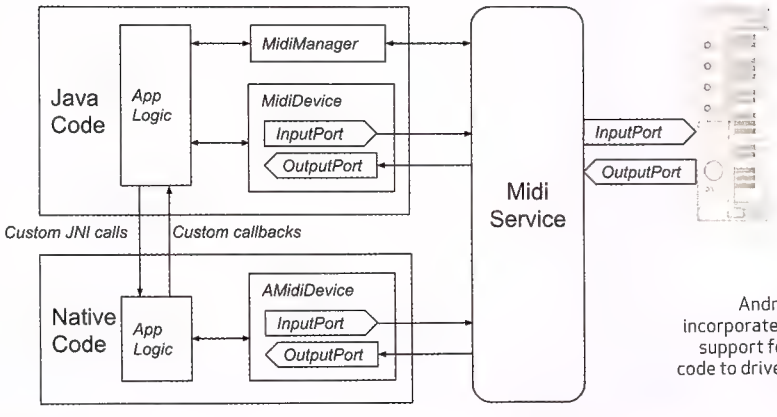
One of the 'slow burn' changes coming to Android phones isn't exactly the result of Android 10, but looks like coinciding rather nicely – and that's high-speed display panels. Since day-dot, phone screens of all persuasions (like many PC screens) have had a standard 60Hz refresh rate. However, over the course of the last 18 months or so, what first started as a trickle has become a steady hum of news from vendors all threatening to launch phones with new high-speed display panels. Gaming brand Razer got the game rolling in 2017 with its Razer Phone, packing in a 5.7-inch Sharp IGZO LCD panel refreshing at a default rate of 90Hz, but settable up to 120Hz.

Razer was no doubt gunning for the gaming market with its higher refresh rate, but in more recent times, we've started seeing the floodgates open, particularly in the last few months, as more brands have either announced or just launched devices with high-speed panels – and not just in flagship models.

But while some bloggers are now more or less claiming they won't get out of bed for anything less than a 90Hz phone, the question is what difference



a) current MIDI framework using Java



Android 10 incorporates new support for C++ code to drive MIDI data.

b) new MIDI framework support C/C++ code

"Razer was no doubt gunning for the gaming market with its higher refresh rate, but in more recent times, we've started seeing the floodgates open."

does a 90, 120 or even 240Hz screen refresh rate actually make? Have we got to the point where everything else in a phone display has been updated over the years and the refresh rate is the last thing to get punters excited about, or is there a genuine benefit to be had?

Like most things, it's not that black-and-white. Because we're dealing with screens that also have a touch interface, there are three factors to consider – 1) the panel refresh rate, 2) the video frame rate and 3) the touch refresh rate. The panel refresh rate is how many times the panel updates the image per second – that's the 60Hz rate we've had on most phones. The video frame rate is the rate content – think videos and games – is produced at and sent to the display panel. The touch refresh rate is how often the touch layer is sampled to receive your instructions.

Factors 1 and 3 are determined by your phone hardware, factor 2 more by software. To get the maximum benefit from higher-speed refresh rates, you need all three factors to operate at higher (and ideally sync-locked) speeds.

However, while there's a good array of games supporting higher refresh rates, there's little streaming content offering 90fps.

However, even without higher frame rates, you'll still see a general improvement in the smoothness of a phone's animations (scrolling, swiping etc) from just a faster refresh rate. It should also feel more responsive to touch with a higher touch refresh rate.

So, which phones have which

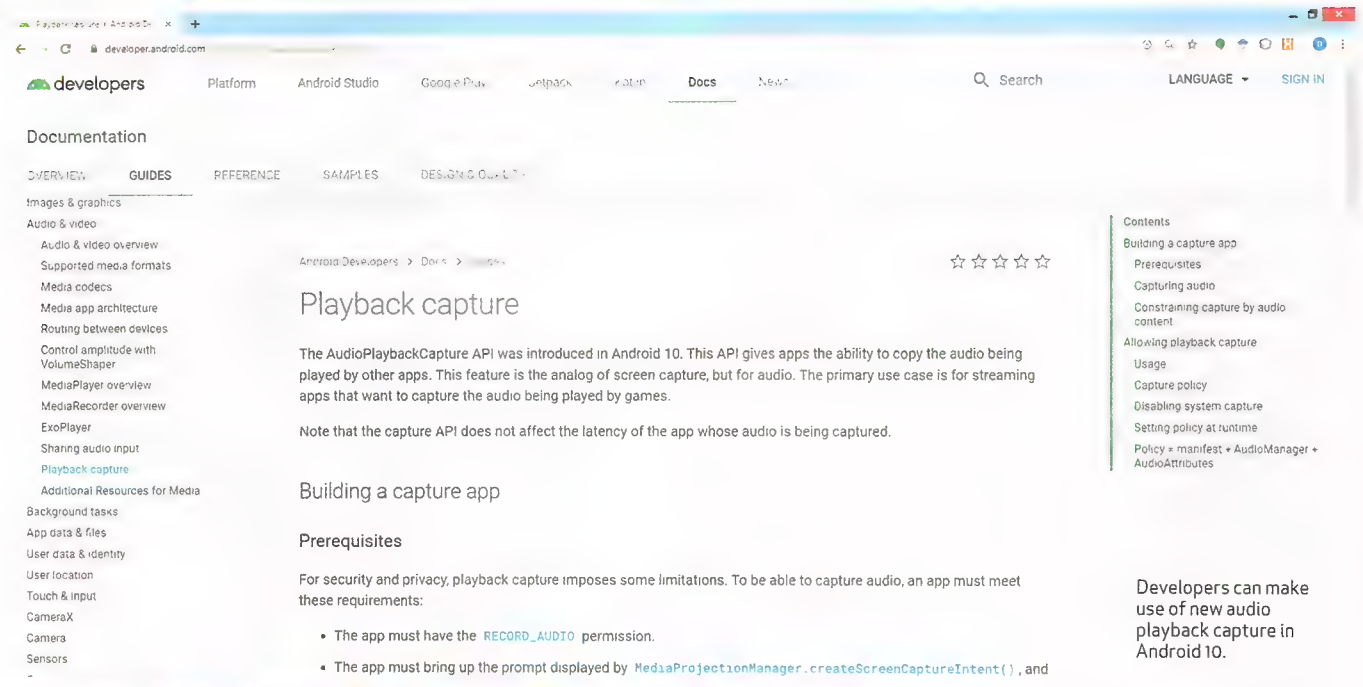
Asus' ZenFone Max Pro M1 is the first with a custom Android 10 AOSP ROM.

improvements? The only phone with a higher touch refresh rate at the moment is the Apple iPhone XS, with its 120Hz touch refresh rate. Users say it's an improvement, however, it's matched to only a 90Hz display refresh rate, so it'd likely improve a bit more if a common 120Hz rate was used.

This is in contrast to the number of higher display refresh rate phones coming out of the woodwork. At the moment, Japanese phone (and well-known LCD panel) maker Sharp holds the title with its new Aquos zero2 phone. We won't likely see it here in Australia officially, but it delivers a whopping 240Hz display refresh rate. Overkill? Possibly, but if the phone could deliver 240fps content to that panel, you'd have to think it'd look as smooth as silk.

The OnePlus 7 Pro and newly-released OnePlus 7T both come equipped with 90Hz panels and if you have the 2017 Razer Phone or its Razer Phone 2 successor, congrats, for you've obviously had up to 120Hz for some time. However, its rumours that Google is looking like dropping a 90Hz panel into the new Pixel 4 XL phone that should get more manufacturers thinking 'refresh rate'. That'll end up meaning one of the biggest changes coming to phones could soon well be staring you in the face – literally.

The OnePlus 7T will be one of the first phones pre-loaded with Android 10.


developers
Platform
Android Studio
Docs
Search
LANGUAGE
SIGN IN
Documentation
OVERVIEW
GUIDES
REFERENCE
SAMPLES
Images & graphics
Audio & video
Audio & video overview
Supported media formats
Media codecs
Media app architecture
Routing between devices
Control amplitude with VolumeShaper
MediaPlayer overview
MediaRecorder overview
ExoPlayer
Sharing audio input
Playback capture
Additional Resources for Media
Background tasks
App data & files
User data & identity
User location
Touch & input
CameraX
Camera
Sensors
Android Developers > Docs >
Playback capture
The AudioPlaybackCapture API was introduced in Android 10. This API gives apps the ability to copy the audio being played by other apps. This feature is the analog of screen capture, but for audio. The primary use case is for streaming apps that want to capture the audio being played by games.
Note that the capture API does not affect the latency of the app whose audio is being captured.
Building a capture app
Prerequisites
For security and privacy, playback capture imposes some limitations. To be able to capture audio, an app must meet these requirements:
The app must have the RECORD_AUDIO permission.
The app must bring up the prompt displayed by MediaProjectionManager.createScreenCaptureIntent(), and
Contents
Building a capture app
Prerequisites
Capturing audio
Constraining capture by audio content
Allowing playback capture
Usage
Capture policy
Disabling system capture
Setting policy at runtime
Policy = manifest + AudioManager + AudioAttributes

Developers can make use of new audio playback capture in Android 10.

Asus' ROG Phone had a 90Hz panel back in 2018.

CONTAMINANT DETECTION

Your phone's USB port really is its lifeblood – you charge your device battery with it, swap files with it, you can even plug in external devices like microscopes if it supports USB-OTG. But Android hasn't offered much in the way of electrically protecting the port should anything go wrong – until now. Android 10 includes smart monitoring and detection support of the USB port electronics. Should any liquid or debris threaten to damage the port, the OS will now have the ability to disable the port, warning you with a notification alert. What's more, it looks like being be part of the 'mandatory' pack of features that all new Android 10 phones will have to support.

There's also another USB feature – and that's overheat monitoring. Word is Android 10 will also be able to warn users if the USB port is overheating (tops 60°), whether it's been on charge too long, or having too much power drawn from it. We reckon this is an important feature, particularly given the prevalence of high-speed charging now available. However, there are a couple of problems here – first, USB temperature monitoring is said to be only an 'optional extra', so it'll be a feature added to flagship phones only, no doubt. The other problem is that it only warns the users that the port is overheating. Unlike the debris and liquid protection, Android 10 will not turn off the USB port if it overheats. That might make some sense, particularly if the phone is supplying power via USB-OTG to an external device, but if it's a charging rate issue, this is where port protection would be useful.

AUDIO PLAYBACK CAPTURE

Android has long had the ability to make screen videos, whether you're making video tutorials or capturing gameplay. For the first time, Android 10 now adds in the ability to capture audio. The primary focus of this feature is to make better gameplay videos and the good news is that according to Google, the AudioPlaybackCapture API (application programming interface) used to grab the audio does not create any latency issues for the games you're trying to capture. However, if you're thinking this could be a new way rip some of your favourite content streams, such as the odd Netflix series, cool your jets.

Capturing audio being played back by another app is essentially a handshake agreement between the two apps – the app playing the audio and the app trying to capture it. Both apps have to allow playback capture, otherwise you get nothing. What's more, you can be sure Netflix will be ensuring its app doesn't allow other apps to capture its audio.

From the Android 10 developers' info, this looks very much an 'opt-in' feature. Developers have to set the app player usage setting to 'usage_media', 'usage_game' or 'usage_unknown'. In addition, the player's capture policy has to be set to 'AudioAttributes.ALLOW_CAPTURE_BY_ALL' before you get any joy. No doubt, you can be sure Netflix and others will be using 'AudioAttributes.ALLOW_CAPTURE_BY_NONE'.

Still, this is a win for gamers and should result in lots of cool new gameplay videos.

CAPTURING GAME AUDIO WITHOUT ANDROID 10

It's complicated, but you can capture game audio and create audio-filled gameplay videos even without an Android 10 device. Connect your phone's headphone socket to your PC's line-in input and record the audio using a good audio editor like Audacity. At the same time, capture the game video stream using a screen recorder app on your

Google's Pixel 4 XL is rumoured to feature a new 90Hz display panel.

phone. Just before you begin game play, you need to create a couple of synchronisation markers – whether that's firing your weapons or whatever, just something you can use to sync up the audio and video streams afterwards. When you're done capturing, bring the two media files into your PC and use a non-linear editor (NLE) app, such as Vegas Movie Studio or whatever, to join them into a single audio-video stream. As I said, it's complicated, but is certainly do-able. Android 10 just means you don't need to do any of this.

IMPROVED MIDI SUPPORT

One of the things iOS has always been pretty good at from a musician's viewpoint is MIDI. Musical Instrument Digital Interface has been around for a thousand years, but it seems like Android has almost always struggled with latency issues, meaning you press a note on a keyboard and sometime later, it's registered in your MIDI app. Android 10 introduces a new Native MIDI API called 'Amidi' and the benefit is that it will allow app developers to send and receive MIDI data using much, much faster C/C++ code.

We won't go into it in depth (I'm not a MIDI expert), however, the way it works is that instead of coding MIDI connections and data using the current Java Native Interface (JNI), app developers will still use Java to set up a MIDI connection, but they'll now be able to send and receive data to and from a MIDI service using C/C++ code using the AMidi API once that MIDI connection has been made.

This should help further reduce latency issues – but like most Android 10 features, you'll have to wait for developers to incorporate the new API calls into new apps.

MULTI-DIRECTIONAL MICROPHONES

Alan Blumlein was a brilliant electrical engineer working for what would become music giant EMI when he invented stereo recording back in 1931. But while recent high-end Android phones now come with two or more microphones, this is has been more about noise-cancelling and improving call quality than genuine 'right-left' stereo recording.

Android 10 doesn't fix this problem specifically, but it does come with a new MicrophoneDirection API. App developers will now be able to select different microphones for different applications, for example, a front-facing mic for selfie videos. Of course, the device has to have more than one mic for this to work, but it's a start.

However, the key feature here is the ability to set what's known as the 'field dimension'. Zoomable microphones are much like a telephoto or zoom lens, in that they allow you to focus the audio area or 'field' the microphone picks up. Android 10 includes a new 'setPreferredMicrophone FieldDimension' interface that uses a decimal or 'float' (floating point) number ranging from -1 (wide angle) to 0 (flat) to 1 (maximum zoom).

As we said, most Android phones still have work to do when it comes to high-quality audio capture features, so we reckon that unless things change, this is a feature most likely to be used by smart home devices, like Google Home, Home Hub and Nest Hub.

THERMAL LOAD MANAGEMENT

When app developers build and release Android apps, they basically have no control over the environment those apps operate in, not just from a performance perspective, but also a thermal one. For example, if your game app runs on a device with all game specs on full, what happens to the device temperature, or its 'thermal load'?

Android 10 includes a new Thermal API that allows app developers to monitor and adjust app power loads. It works by the app developer writing a 'listener' function that eavesdrops on Android's PowerManager feature. PowerManager is where Android updates all things 'power management', from processing load and thermal performance. App developers will be able to monitor the thermal stress of the device on a six-level scale, starting at 'light' and progressing to 'moderate', 'severe', 'critical' and 'emergency'. If you get back 'shutdown', that's Android saying the universe is about to implode.

The downside to this is the Android warning that mucking around with PowerManager means 'device battery life will be significantly affected'. Still, possibly better that than your phone melting like the sun in your hand.

INCREMENTAL IMPROVEMENTS

There may be no more ice-cream sandwiches, lollipops or pies, but Android 10 actually does have plenty of new features, some you'll hear lots about, others you won't. Many of these features will allow app developers to build new apps with greater hardware capabilities, from being smarter with temperature loads to smoother user interfaces and more versatile audio. Not to mention some silky new display panels. ■

New code in Android 10 will disable the USB if liquid or debris cause issues.

The Aquos R3, the latest Sharp phone fitted with a 120Hz HDR10 display.

Controlling the Pi from a web-based app

Les Pounder shows us how to create a web app using pure Python to control the Raspberry Pi GPIO.

We're going to create a web interface using Anvil that uses just Python. This interface will enable us to control real components: a red and blue LED along with a buzzer, connected to a Raspberry Pi.

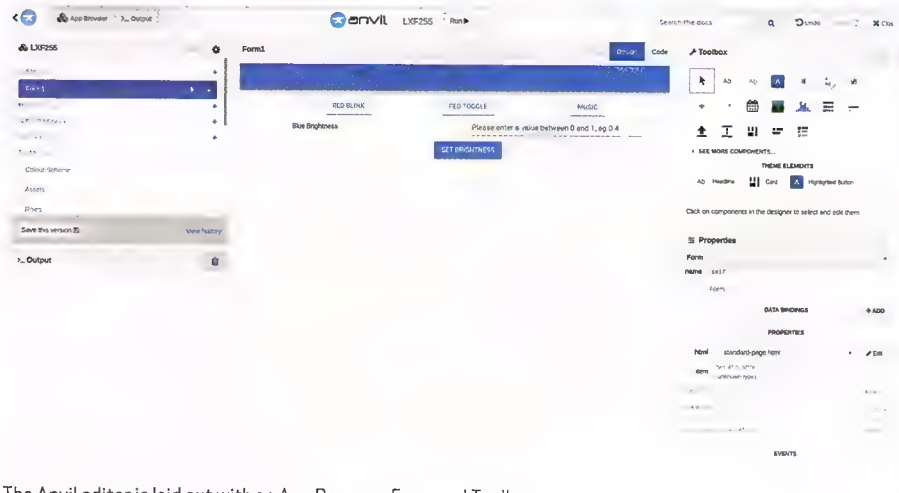
The hardware build for this project is just two LEDs, one connected to GPIO17 and the other to GPIO27. We used a 330 Ohm resistor to connect each LED to the GND pins of a Raspberry Pi 4. The buzzer is connected to GPIO22 and GND, and requires no resistor. Please see the diagram in the download for this project for detailed information.

Writing the code

On a PC visit **https://anvil.works** and create a free account by clicking Start Building. Follow the sign-up instructions, then click Create App,appear then select the theme Material Design. In Anvil the layout is as follows. On the left is an App Browser used for configuration. In the centre is where our app – called a form in Anvil – is designed using elements from the top right of the screen, called the Toolbox. You will see 'Material Design' as the name of the app in the top left of the screen; change this to 'GPIO Control' by clicking the text.

Next we need to add three buttons to the form. The Button tool can be found in the toolbox, just hover the mouse over the icons to identify them. Drag each button over to the form and place them next to each other. For each button change the 'text' field in the properties menu (bottom right of screen) to the following values: RED BLINK, RED TOGGLE, MUSIC. The next step is to place a Label from the toolbox under the buttons, and then change the label text to "Blue Brightness". To go with this label we need a TextBox; drag it so that it's horizontal next to the label and change the placeholder text to "Please enter a value between 0 and 1, eg 0.4". Now add another button, this time placed underneath the previous components. Change the text to "SET BRIGHTNESS".

Anvil apps are made using a design tool, but accessing the code underneath is just a double-click away.



The Anvil editor is laid out with an App Browser, Form and Toolbox, which hide a wealth of features and functionality.

You need

- Any model of Raspberry Pi
- A desktop/ laptop
- Internet connection
- Breadboard
- 2x 330 Ohm resistors (Orange, Orange, Brown, Gold)
- 2x LEDs
- Buzzer
- 6x female-to-male jumper wires
- Code: **https://github.com/lesp/LXF255/archive/master.zip**

To enable this app to communicate with our Raspberry Pi we need an API key. In the top left of the screen is a cog settings menu. Click it and select Uplink. There will be a button to get your server API key. Click the button and copy/save/write down this key.

With that complete we can now write some code for the Anvil web app. Double-click the RED BLINK button. This will automatically take us to the appropriate section of code, which is a function. Replace `pass` with the following code, make sure that it is indented to match how `pass` was formatted.

```
anvil.server.call("red_blink")
```

Make a note of `red_blink` as we shall be reusing that on the Pi. To go back to the form, click Design. Now change the code for the two other buttons in the same manner as before.

RED TOGGLE:

```
anvil.server.call("red_toggle")
```

MUSIC:

```
anvil.server.call("music")
```

The final button is SET BRIGHTNESS and for this we need to add a different line of code. Double-click the button to edit.

```
anvil.server.call("blue_brightness", float(self.text_
```

```
box_1.text))
```

This will call a function on our Raspberry Pi called `blue_brightness` and it will pass a value stored in the TextBox that will control the LED on our Pi. That's all of the code for Anvil, but before we move on to the Raspberry Pi, press RUN on Anvil to start the app. Nothing will happen until we write the code for the Pi.

Power up the Pi and boot to the desktop. Before we can write any code for the Pi we need to open a terminal and install the `anvil-uplink` Python library.

```
$ sudo pip3 install anvil-uplink
```

To write the Python code open your favourite Python editor and create a new file called **blink.py**. We start by importing the libraries for our code.

```
from gpiozero import LED, PWMLED, TonalBuzzer
from gpiozero.tones import Tone
from signal import pause
from time import sleep
import anvil.server
```

We import the LED, PWMLED and TonalBuzzer classes from GPIO Zero, enabling us to control LEDs and the buzzer. Then we import Tone to control the pitch of the buzzer. `pause` stops our code from exiting, and `sleep` is used to control the pace of the code. Lastly we import the Anvil uplink server. To connect this Pi to the Anvil app, you will need your API key:

```
anvil.server.connect("YOUR API KEY")
```

In order for the LEDs and buzzer to be used we need to tell Python to which GPIO pins they are connected to.

```
red = LED(17)
blue = PWMLED(27)
b = TonalBuzzer(22)
```

The buttons in our Anvil app make calls to functions that we will write in the code, but in order for that to work we need to use a decorator to instruct anvil-uplink. The first function is to toggle the red LED on and off via the RED TOGGLE button in Anvil.

```
@anvil.server.callable
def red_toggle():
    red.toggle()
```

Another function to flash the LED every half a second when the RED BLINK button is pressed:

```
@anvil.server.callable
def red_blink():
    red.blink(0.5,0.5)
```

The next function takes the `float` value (between 0 and 1.0) stored in the text box and uses it to control the brightness of the blue LED.

```
@anvil.server.callable
def blue_brightness(brightness):
    blue.value = brightness
```

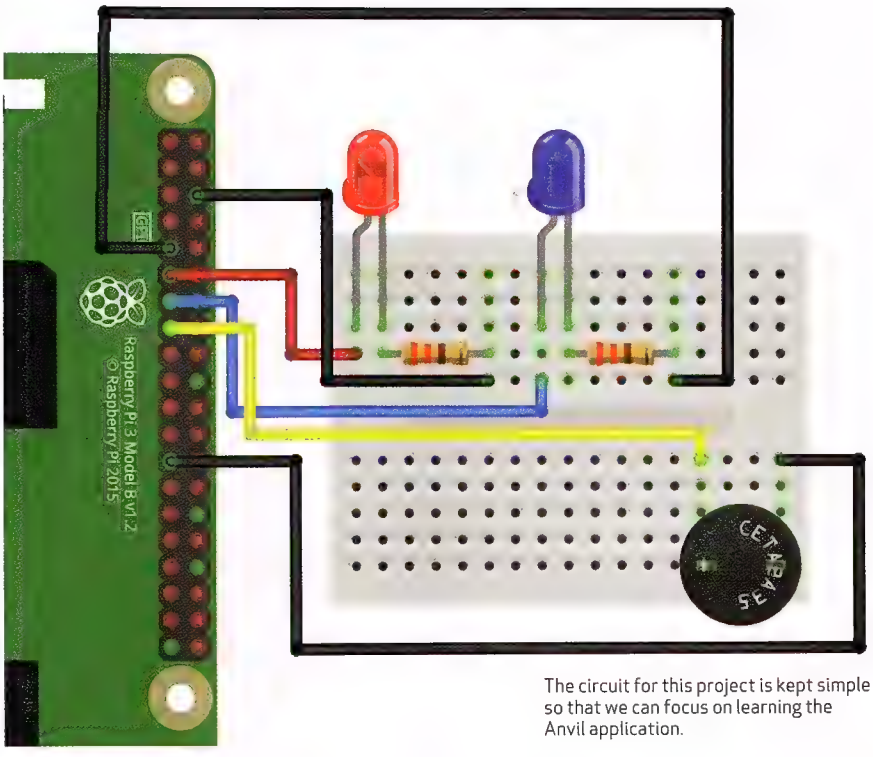
The last function will play music via the buzzer – the first few notes of **Twinkle, Twinkle, Little Star**. We use the `Tone()` function in GPIO Zero to play specific notes, with pauses between each note to control the tempo. Also note that there has to be a stop at the end, or the note will never stop playing!

```
@anvil.server.callable
def music():
    b.play(Tone("C4"))
    sleep(0.2)
    b.play(Tone("C4"))
    sleep(0.2)
    b.play(Tone("G4"))
    sleep(0.2)
    b.play(Tone("G4"))
    sleep(0.4)
    b.play(Tone("A4"))
    sleep(0.2)
    b.play(Tone("A4"))
    sleep(0.2)
    b.play(Tone("G4"))
    sleep(0.2)
    b.stop()
```

The last two lines of code ensure that the project keeps running and waiting even when a button has not been pressed.

```
pause()
anvil.server.wait_forever()
```

With the code completed on the Pi, save and run. You will see the code connect to the Anvil service and this is where we need to switch back to our computer running the Anvil app. Press the buttons to toggle the LED on/off, or to make it flash. To use the blue LED, first type in a value between 0 and 1.0 and then press SET BRIGHTNESS to turn it on. Lastly there is the MUSIC button, which will play **Twinkle, Twinkle, Little Star** using the buzzer.



The circuit for this project is kept simple so that we can focus on learning the Anvil application.

What else can Anvil be used for?

Anvil is much more than just a tool to control a Raspberry Pi. Anvil has many more features, such as data tables to record data, email, user authentication, Google and Facebook APIs, and Stripe to take payments. What does this all mean? Well, using Anvil we can build an app to enable payments to be made, recorded into a data table and then visualised using the built-in graphing library, plotly.

Anvil apps can be shared using a private URL for internal use, or via a public short URL that can be shared on social media. Anvil can also work with devices that deal with web data, for example ESP8266 and ESP32 boards. These boards are cheap and using low power, they can gather data in the field and then send that data to an HTTP endpoint, for example an Anvil data table.

The free Anvil plan has plenty of features to power most projects and it would be well worth investigating further. Anvil is flexible enough to be used simply, but it can also form the heart of more complex projects. So give it a try today!

How image recognition works

Machine-learning can learn almost anything – even to recognise images. Darren Yates explains how using the Python programming language and Scikit-Learn library.

Image recognition is one of the hottest areas right now, not just in 'artificial intelligence' circles, but in tech in general. It's used in everything from detecting postal addresses on mail to faces in the street and weeds in the paddock. But how does it work? How does AI not only distinguish between different images, but recognise what an image contains?

PATTERNS AND ALGORITHMS

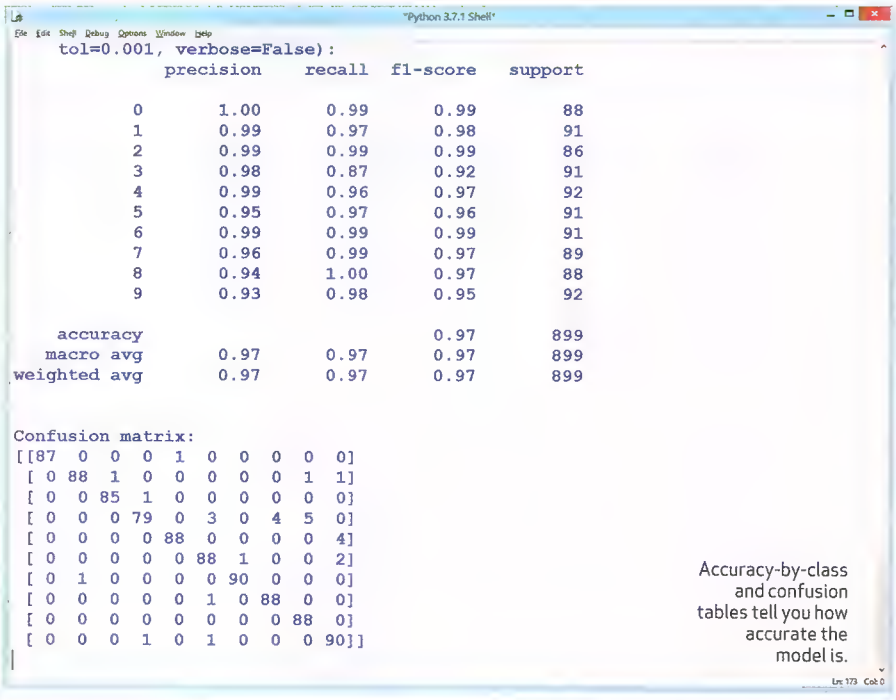
This will sound dopey, but go with me for a sec. Take a look at your family photos and you'll recognise your family members. Why? Because you've seen them before – your brain has been 'trained' to recognise those people by associating different images with different people.

Machine-learning is no different. Most machine-learning algorithms can't do much on their own – they need to be trained with examples of things you want them to learn. In the process of that training, they produce a recipe or 'model' that explains how the learning works. The fuel for machine-learning is data and invariably this data looks like a standard spreadsheet. Across the top, you have columns where each column represents a particular feature of the objects you want the algorithm to learn. For example, say we're trying to learn different vehicle types from their features or 'attributes' – those attributes would include engine size, number of doors, number of wheels and so on. One of those columns is the category or 'class' the object belongs to, for example, truck, car, motorcycle etc. Each row of the spreadsheet represents one complete example of object. To be able to recognise or 'classify' different objects, a machine-learning algorithm is essentially looking for patterns in the data.

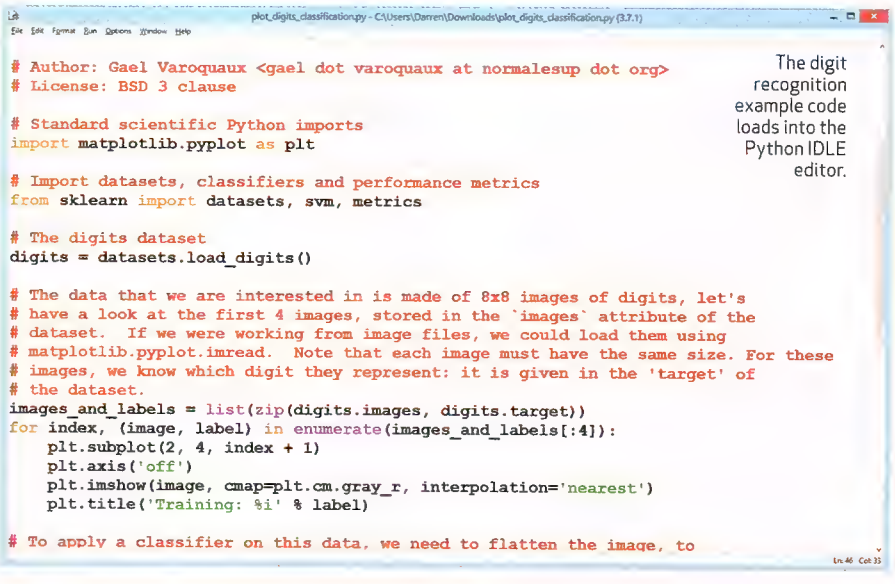
LOTS OF PIXELS

Any digital image is a series of pixels. If you have a basic 320x240-pixel image, you have a series of dots or 'pixels' in a 320 column-by-240 row grid, where each dot is a particular colour. If it's a standard digital photo, it'll likely be a 24-bit image, meaning that each pixel has three separate one-byte (255 levels) values of red, green and blue. The three bytes are typically combined into one 24-bit number representing one of 16.7million possible colours.

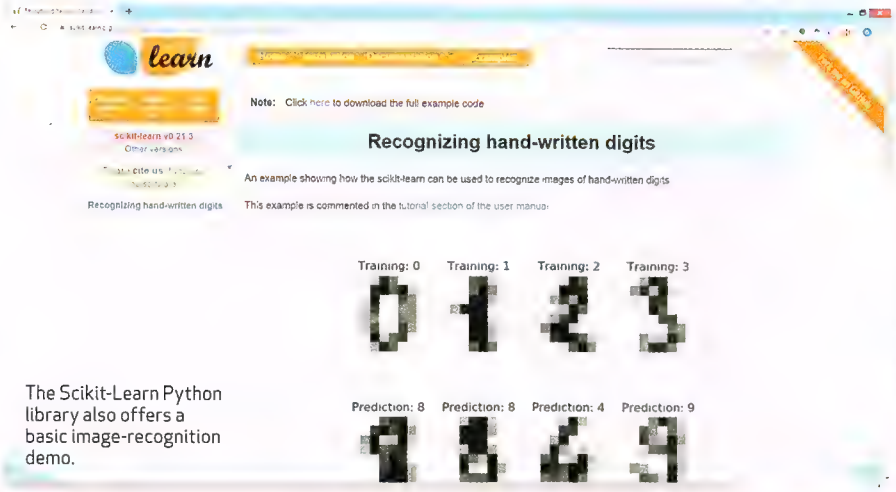
If we want a machine-learning algorithm to learn to recognise a series of 320x240-pixel images, we need to create a 'record' (spreadsheet row) for each image such that all of those pixels are on a single row. In this case, we have to take all 240 rows of pixels and place them side-by-side, so that instead



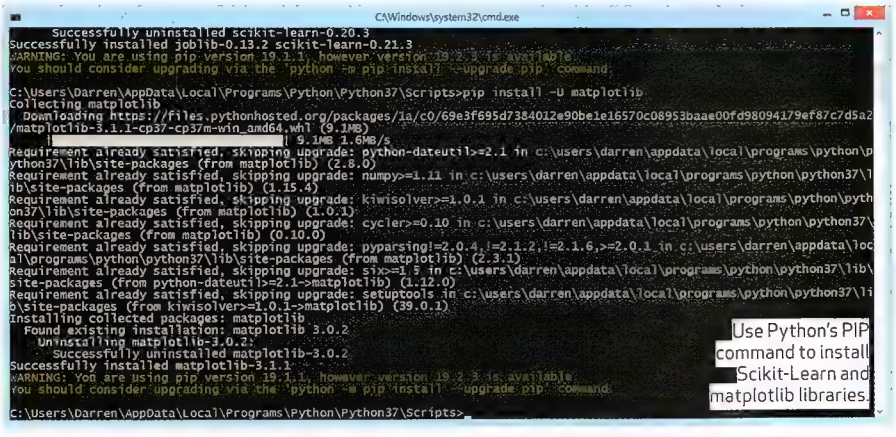
Accuracy-by-class and confusion tables tell you how accurate the model is.


plot_digits_classification.py - C:\Users\Darren\Downloads\plot_digits_classification.py (3.7.1)
File Edit Format Run Options Window Help
# Author: Gael Varoquaux <gael dot varoquaux at normalesup dot org>
# License: BSD 3 clause
# Standard scientific Python imports
import matplotlib.pyplot as plt
# Import datasets, classifiers and performance metrics
from sklearn import datasets, svm, metrics
# The digits dataset
digits = datasets.load_digits()
# The data that we are interested in is made of 8x8 images of digits, let's
# have a look at the first 4 images, stored in the `images` attribute of the
# dataset. If we were working from image files, we could load them using
# matplotlib.pyplot.imread. Note that each image must have the same size. For these
# images, we know which digit they represent: it is given in the 'target' of
# the dataset.
images_and_labels = list(zip(digits.images, digits.target))
for index, (image, label) in enumerate(images_and_labels[:4]):
plt.subplot(2, 4, index + 1)
plt.axis('off')
plt.imshow(image, cmap=plt.cm.gray_r, interpolation='nearest')
plt.title('Training: %i' % label)
# To apply a classifier on this data, we need to flatten the image, to

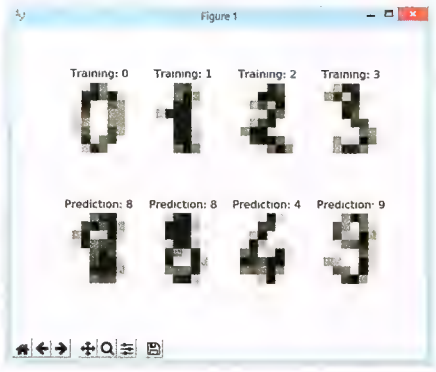
The digit recognition example code loads into the Python IDLE editor.


learn
Note: Click here to download the full example code
Recognizing hand-written digits
An example showing how the scikit-learn can be used to recognize images of hand-written digits
This example is commented in the tutorial section of the user manual
Training: 0
Training: 1
Training: 2
Training: 3
Prediction: 8
Prediction: 8
Prediction: 4
Prediction: 9

The Scikit-Learn Python library also offers a basic image-recognition demo.


C:\Windows\system32\cmd.exe
Successfully uninstalled scikit-learn-0.20.3
Successfully installed joblib-0.13.2 scikit-learn-0.21.3
WARNING: You are using pip version 19.1.1, however version 19.2.3 is available.
You should consider upgrading via the 'python -m pip install --upgrade pip' command.
C:\Users\Darren\AppData\Local\Programs\Python\Python37\Scripts>pip install -U matplotlib
Collecting matplotlib
Downloading https://files.pythonhosted.org/packages/1a/c0/69e3f695d7384012e90be1e16570c08953baae00fd98094179ef87c7d5a2/matplotlib-3.1.1-cp37-cp37m-win_amd64.whl (9.1MB)
9.1MB 1.6MB/s
Requirement already satisfied, skipping upgrade: python-dateutil>=2.1 in c:\users\darren\appdata\local\programs\python\python37\lib\site-packages (from matplotlib) (2.8.0)
Requirement already satisfied, skipping upgrade: numpy>=1.11 in c:\users\darren\appdata\local\programs\python\python37\lib\site-packages (from matplotlib) (1.15.4)
Requirement already satisfied, skipping upgrade: kiwisolver>=1.0.1 in c:\users\darren\appdata\local\programs\python\python37\lib\site-packages (from matplotlib) (1.0.1)
Requirement already satisfied, skipping upgrade: cycler>=0.10 in c:\users\darren\appdata\local\programs\python\python37\lib\site-packages (from matplotlib) (0.10.0)
Requirement already satisfied, skipping upgrade: pyparsing!=2.0.4,!=2.1.2,!=2.1.6,>=2.0.1 in c:\users\darren\appdata\local\programs\python\python37\lib\site-packages (from matplotlib) (2.3.1)
Requirement already satisfied, skipping upgrade: six>=1.5 in c:\users\darren\appdata\local\programs\python\python37\lib\site-packages (from python-dateutil>=2.1->matplotlib) (1.12.0)
Requirement already satisfied, skipping upgrade: setuptools in c:\users\darren\appdata\local\programs\python\python37\lib\site-packages (from kiwisolver>=1.0.1->matplotlib) (39.0.1)
Installing collected packages: matplotlib
Found existing installation: matplotlib 3.0.2
Uninstalling matplotlib-3.0.2:
Successfully uninstalled matplotlib-3.0.2
Successfully installed matplotlib-3.1.1
WARNING: You are using pip version 19.1.1, however version 19.2.3 is available.
You should consider upgrading via the 'python -m pip install --upgrade pip' command.
C:\Users\Darren\AppData\Local\Programs\Python\Python37\Scripts>

Use Python's PIP command to install Scikit-Learn and matplotlib libraries.



Examples of training images and the predictions made by the model.

of 320x240-cell spreadsheet, we create one row with 76,800 columns, plus one extra that is the 'class' column or 'attribute' that says what this image is.

So, there are two things happening – one is the algorithm has to learn the patterns within those 76,800 columns that distinguishes images, plus it has to associate images with different class values.

HAND-WRITTEN DIGITS

A really simple example of this is available in the Python Scikit-Learn library called 'digits'. It's a series of 5,620 images of hand-written digits 0 to 9. Each image is 8x8-pixels, so pretty tiny, but in order to be useable in machine-learning this 'dataset' exists as a series of 5,620 rows, each with 64 columns, plus one column or 'class' that labels the row with the digit it is supposed to be. Once an algorithm has created a model from these images, that model can be used to identify or 'classify' similar images that have not been previously seen.

This is an example of what's called 'supervised' learning, because the algorithm is essentially given the answers in the data. Think back to when you learned maths at school – you were given examples to do and those examples had answers. In machine-learning, this is the 'training' phase. Once you learned how to do a particular maths task, you had to prove you knew how to do by doing it in an exam and providing your own answer. Not surprisingly, this is the 'testing' phase in machine-learning too.

GET THE CODE

Grab a copy of Python for your PC from python.org/downloads and install it. Launch a command prompt in the following folder:

```
\users\<username>\appdata\
local\programs\python\
python37\scripts
```

replacing `<username>` with your username.

In the command prompt, type the following:

```
pip install -U scikit-learn
pip install -U matplotlib
```

and hit the <enter> key after each one.

Once you've done that, head over to the scikit-learn website and the 'Recognizing hand-written digits' page (**tinyurl.com/y5tchmgw**). Scroll down to the bottom of the page and click on the 'Download Python source code... py' button. When the download is complete, open up the IDLE integrated development environment, select File, Load and load up the file you just downloaded. When you're ready, press the F5 key or select 'Run', 'Run module' from the menu.

After a few seconds, you'll get output on the Python Shell window, plus a second window labelled 'Figure 1' with some admittedly dire-looking hand-written digits.

WHAT'S IT ALL MEAN?

Looking at 'Figure 1' first, the top row shows four of the 'training' images – these are 8x8-pixel images with a 'class' value identifying the number the image is supposed to show. Underneath is examples of the 'testing' images – these show an image, plus the predicted 'class' value the learned model thinks the image represents. Or, in other words, the number the model thinks the image looks like.

Now looking back at the Python Shell output, what's produced here is first of all, an accuracy-by-class report. It shows the accuracy of the model to recognising the images by their possible values 0 through to 9. You can see down the 'precision' column accuracy was at worst 0.93 (93%) for digit '8' and at best 1.0 (100%) for digit '0'. The overall or 'weighted' average is 0.97 (97%). The 'support' column is the number of images classed as that particular digit, with a total of 899 images used for testing.

Underneath is what's called a 'confusion matrix', not because it causes confusion, but as a way of understanding the difference between what an image really is (going down the rows) and what the model thinks or 'predicts' it is (across columns). Think of it as the difference between the correct answers in an exam and the answers you give. Ideally, you should have numbers only going down the centre-diagonal and the rest should be '0'. This would be 100% accuracy.

TRY IT YOURSELF

The algorithm used in this example is called a 'support vector machine' (SVM), but you could use a decision tree or a multi-tree algorithm such as 'RandomForest' to give similar results. Image recognition has application in many areas, so it's well worth even learning the basics of how it works.

downtime

WHAT'S HAPPENING IN THE WORLD OF FUN.

Nvidia is retrofitting ray tracing into more classic games

THE COMPANY HAS TASKED LIGHTSPEED STUDIOS WITH MAKING FANCY REFURBISHMENTS.

Nvidia is keen to show off what its RTX cards can do, with the company tasking an internal studio with refurbishing classic PC games with ray tracing support. It has already released a *Quake 2* update, and a *Minecraft* update is forthcoming, but a recent job listing suggests that more are coming, with speculation rife that the likes of *Doom 3* and *Half-Life 2* might be among them.

Postal is back

FOR BETTER OR WORSE.

Postal 4 has been announced and released in October, launching to Steam's Early Access program. The mayhem mostly involves fire and pee being rained down on the new town of Edensin by the series' protagonist the Postal Dude and buddy Champ. The sandbox FPS will take place in the open-world town of Edensin where the Postal Dude spends five days checking off errands from his list of nasty deeds.

Red Dead Redemption 2 is confirmed for PC

ROCKSTAR GAMES FINALLY REVEALS PORT.

Nearly a year after its initial release on PS4 and Xbox One, Rockstar Games has announced that *Red Dead Redemption 2* will launch on PC later this year. The news comes weeks after the unveiling of a new Rockstar Launcher, but while the game will be available on that platform (with certain perks, including free Rockstar games), it'll also release for Steam and the Epic Games Store. It has an official release date of November 5.

Blizzard under fire for treatment of pro-Hong Kong activist

Hearthstone pro Chung 'blitzchung' Ng Wai kickstarts a ruckus.

Hearthstone Grandmaster Chung 'blitzchung' Ng Wai inadvertently kickstarted a PR disaster for Blizzard last month, when he showed support for pro-democracy Hong Kong protesters during an official *Hearthstone* livestream. The company was quick to respond, initially imposing a twelve month ban on blitzchung, in addition to forfeiting all prize money related to the Grandmaster tournament.

The backlash was momentous. Fans, industry figures and even some Blizzard employees protested the move, resulting in Blizzard softening its punishment via a six month reduction of the suspension, in addition to the rewarding of the prize money. Blizchung later wrote that he was "grateful for Blizzard reconsidering their position about my ban" and that he will be "more careful... and express my opinions or show my support to Hong Kong on my personal platforms." Still, anti-Blizzard sentiment is rife and shows no sign of abating in the lead up to the 2019 Blizzcon convention.

Riot unloads with nearly half-dozen new titles, after years of League of Legends reliance

THE COMPANY IS RELEASING A CCG, AN FPS, A FIGHTING GAME AND MORE.

League of Legends has been Riot Games' highest priority for the past decade, but with the recent release of Teamfight Tactics – and a slew of forthcoming games – that looks set to change. During a *League of Legends* 10th Anniversary livestream in mid-October, the Californian company made a handful of surprise announcements, spearheaded by *Legends of Runeterra* – a CCG to rival *Hearthstone* that does away with random purchased card packs in favour of a more transparent monetisation method.

The company also announced *League of Legends: Wild Rift*, a new 5V5 MOBA designed especially for consoles and mobile. A rumoured mobile version of *Teamfight Tactics* was also unveiled, but most surprising was confirmation that the studio is working on a tactical shooter separate from the *League of Legends* universe, as well as a fighting game set within it. Finally, the company is developing an animated series set in the world of *League of Legends*.

Former Bioware writer David Gaider is setting up a new studio in Australia

Get ready to fall in love with Summerfall Studios.

David Gaider is no stranger to Australian shores – he's spent time at a number of our international gaming events, and it looks like he's set to become an even greater fixture of the local gaming scene. He, along with GX Australia alumni Liam Esler, has just announced the creating of a new development house – Summerfall Studios.

The new studio had its official launch at PAX Australia, alongside the launch of a Kickstarter to fund its first game – Chorus. Details are pretty sparse on the ground at the moment, but Summerfall Studios' website promises "an illustrated character-driven adventure", before going on to say that "Summerfall Studios will crush your dreams and tear out your heart... in the very best way."

Given Gaider's illustrious resume, with writing credits on the first two *Dragon Age* games, *Knights of the Old Republic*, and *Baldur's Gate 2*, we're expecting some amazing drama and angst. Esler's writing credits include *Pillars of Eternity* and *Baldur's Gate II: Enhanced Edition*.

Blizzard says Nintendo can choose "whatever character you want" for Overwatch Smash Bros DLC

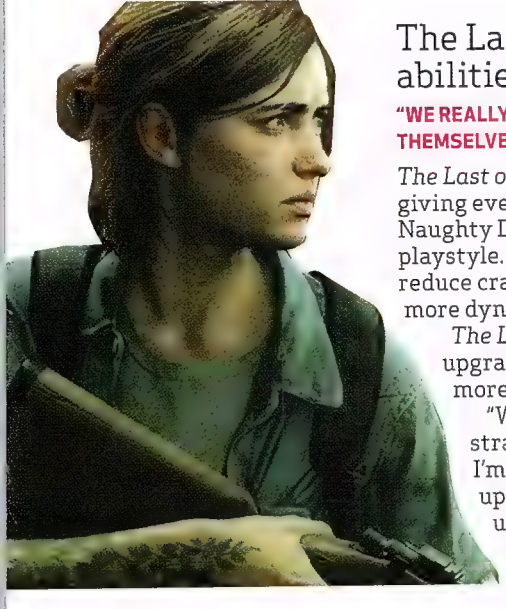
"THEY'RE ALL OUR BABIES".

As the *Overwatch* game director Jeff Kaplan has offered up his thoughts on whether *Super Smash Bros Ultimate* could receive new fighters from the world of Blizzard's multiplayer hero shooter. "To the *Smash Bros* team, [you can have] whatever character you want", Kaplan revealed in a recent interview with *IGN*. "We love them all. They're all our babies, you can have any single one of them. We have 31 to choose from."

A new Fortnite map could be on the way, according to the latest data mine

LEAKS SUGGEST SOME BIG CHANGES COULD BE COMING TO *FORTNITE*.

Player Lucas7yoshi posted a tweet with a list of names for new locations that could be coming to the *Fortnite* map. The location names were found in the game's code files, and all of them sound quite familiar, which seems to give the data mined locations some legitimacy. A few locations are familiar. Weeping Woods, for example, is not far off from the Wailing Woods that was eventually replaced by Sunny Steps.



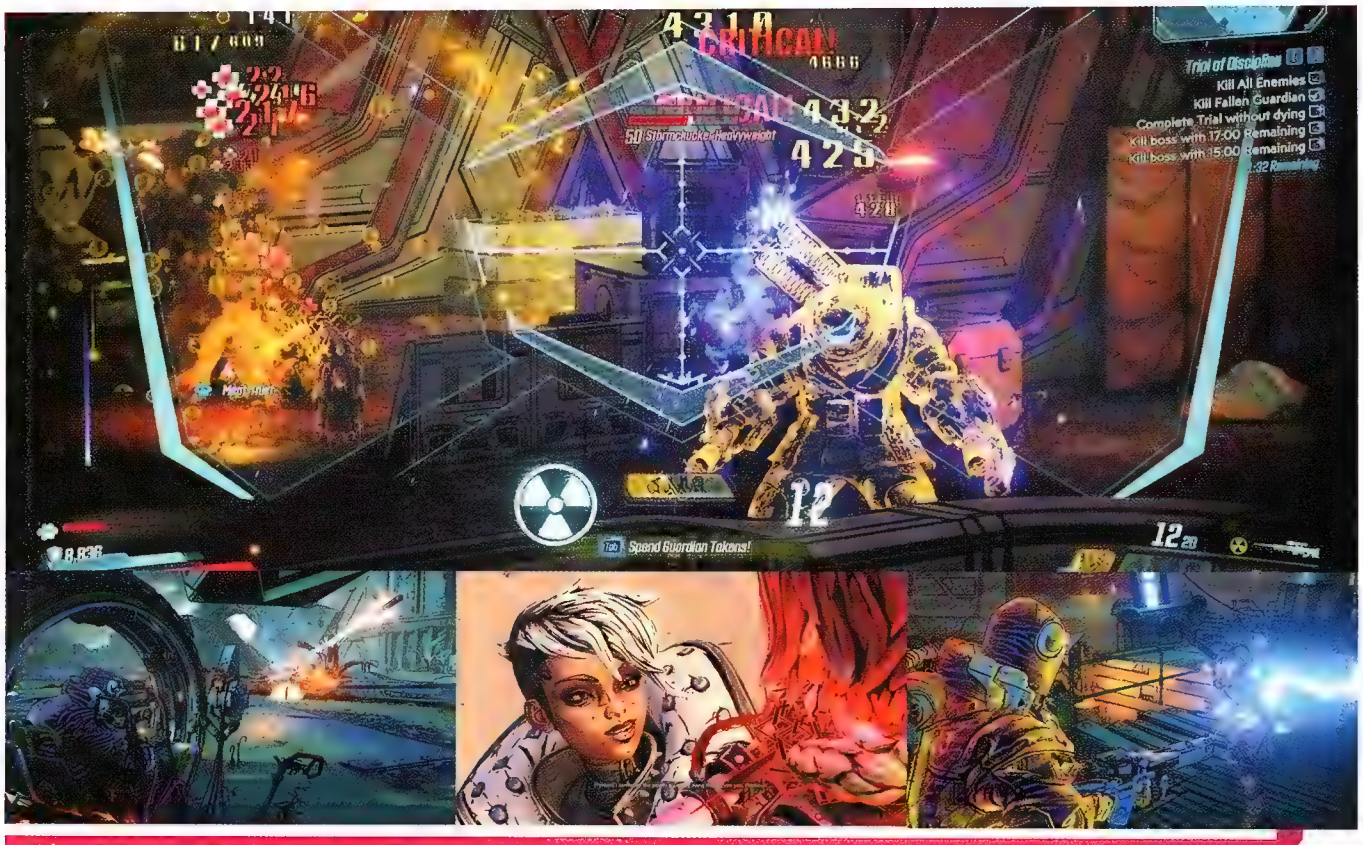
The Last of Us 2 upgrades can unlock entire new abilities like holding your breath to aim

"WE REALLY WANTED TO TRY AND DOUBLE-DOWN ON ALLOWING PLAYERS TO EXPRESS THEMSELVES STRATEGICALLY".

The Last of Us 2's upgrade system will upgrade the upgrades from the original game. On top of giving every character a working heartbeat to make you feel even more like a monster, Naughty Dog is expanding the ways that you can shape your character's growth to fit your playstyle. The incremental ability buffs from the first game, which could increase your health, reduce crafting time, and give other passive increases, will be joined or outright replaced by more dynamic tweaks to how you play.

The Last of Us 2 co-director Anthony Newman explained how the game's new approach to upgrades will work in an interview with GameSpot, saying Naughty Dog wanted to explore more possibilities for players to discover and refine their own favorite strategies.

"We really wanted to try and double-down on allowing players to express themselves strategically and find their own way to play the game," Newman said. "And so something I'm really thrilled about is the new player upgrade system where rather than having upgrades that are just minor stat booths to different things, we really wanted to have upgrades that potentially unlocked entirely new abilities or just had drastic effects on the way that you played a game."



$70 | BORDERLANDS.COM | PC, XB1, PS4, STADIA

Borderlands 3

Wild guns fall to bad jokes.

Borderlands 3 is stuck in a time when memes lasted months rather than days, when referential humour was still a novelty and not exhausting, when you could point at something the slightest bit abnormal or gross and call it a joke. Simpler times, not necessarily better times.

Borderlands 3 feels like a retro shooter rather than alive and present in modern humour and pop culture. It's simultaneously repulsive and compulsive, an FPS RPG that excels when its weapon generation system spits out guns that feels great to shoot, adorned with broken attributes capable of turning hordes of goons, bugs, and soldiers into clouds of red mist, elemental particles, explosions, and big damage numbers. Then it tells one of its many long, bad jokes and the cloud dissipates.

It's still a *Diablo*-like masquerading as a shooter, now with new traversal moves, gorgeous gun models, and improved weapon feedback. But Gearbox has done little to build on the *Borderlands* formula, while chucking the pitch perfect writing of *Tales From the Borderlands* in the bin. It's the best and the worst of the series at once.

It irreversibly changed what I expect from the series. *But Borderlands 3* opts for a best-of approach, something like a sitcom clip show. The new space travel setup takes the player on a tour of the galaxy in search of yet more vaults, each stop an excuse to roll out an old character only for them to disappear or fade into the background as soon as they say hello, shoot some folks, and crack a few one-liners in sidequests that do little to reveal anything about them or test them in any way.

The new locations are a welcome change of scenery from the muted deserts of Pandora. Eden-6 is your typical swampy jungle, where dinos and poo-tossing jabbers chase me around the swamps and through the treetops. Promethea is a slick corporate dystopia composed of uniformly branded architecture and bright neon lighting. Each location has its own enemy types, though in practice there's not much difference between fighting a swarm of COV soldiers or a swarm of bandits. *Borderlands 3* usually tests players with a mess of enemies in open, multi-tiered arenas, more of a war of attrition than a tactical puzzle. Besides a few tough bosses, the true challenge comes from deciding whether to shelve a badass electro- pistol that basically works like a super shotgun or a fiery SMG that shoots a heart-shaped bullet spray for a plain weapon with an elemental affinity better suited to a region's enemies.

Between the bugs, the extended non-jokes, the self-aggrandising jabs at game design trends, and a few groan-worthy cameos, *Borderlands 3* has a lot in common with Gearbox fan events as of late. An excess of loud, extended posturing holding what everyone really came for hostage. It's a shame, because a better *Borderlands* is actually possible, but it's just not *Borderlands 3*. ■

James Davenport

Verdict

An endless font of bad jokes and cool guns in the series' most vapid story yet.

★★★☆☆

US$19.99 | GOOSE.GAME | PC, MAC, SWITCH

Goose Game

Renegade Shepard's got nothing on you in this.

There aren't nearly enough games that let you play the villain. The beauty here is that, as much as it might feel like it on occasion, geese are not evil creatures. I, on the other hand, take immense pleasure in being horrible and therefore, I love this game.

Controls are simple, never getting in the way of your desire to wreak havoc. Hold one button to run rather than waddle, one to lean down, another to flap your wings, another to grab or drop things – and that's it, really. Objectives are presented via a 'to do' list in the pause menu, and almost exclusively involve making the lives of the villagers miserable.

The game begins just outside a small garden and, once I'm in, I'm giggling with glee within seconds. The waddling animation is endlessly captivating, and it is literally impossible to dislike a game that opens with "press X to honk" – but my first human encounter really seals the deal. One of the first objectives I complete is to steal the gardener's keys, snatching them right off his trousers. I then make a run for the

lake, honking triumphantly as he gives chase, dropping them into my watery domain far out of his reach before smugly paddling around without a care in the world. Later I'll get the sod wet, steal his lunch, make him buy back his own trowel, and more. This, I'll remind you, is the first area of the village.

Once the whole village is open to you, each area presents the optional challenge of completing all its objectives within a tight time limit. This requires forward planning and, sometimes, a change in tactics if the way you usually do things is too time consuming.

There's no denying that once you approach the six hour mark, the joke (slowly) begins to wear thin, the small size of the village meaning you'll have repeated yourself a lot. But that really doesn't matter. This wasn't designed for *GTA* levels of playtime, and I can't remember the last game that made me laugh so often while I was playing it. ■ Luke Kemp

Verdict

Hilarious, bursting with charm and satisfying to play.

★★★★☆

Discomfort

Resident evil of your own making.

FREE | BIT.LY/DISCOMFORTING | PC

Discomfort can be a pretty uncomfortable game to play. You're a woman in a house trying to summon a folkloric creature, a process that involves adventure-game-style scene examining, item collection and simple puzzling. *Discomfort* successfully transports you back to the glorious 1990s, first with its crude textures, and then with its control scheme, which not only places you in the body of a '90s protagonist, but in the body of the '90s player controlling her. *Discomfort* is fully realised, mostly uncompromising nostalgia. You're attempting to bring the monster to you, in a house that may not be your own, and where there's a dead body lying unceremoniously in one of the beds. Following a set of instructions, you'll supply a summoning circle with a range of creepy items including your own hair and, er, a body part, while finding the time to play on an old Game Boy left lying around. *Discomfort* puts the effort in, with its intriguing premise and short, but well-paced story. ■ Tom Sykes

★★★★☆

NEED TO KNOW
RELEASED 2005
DEVELOPER
Rockstar North
PUBLISHER Rockstar Games
LINK www.rockstargames.com/sanandreas

Not quite as impressive as the Vinewood sign in GTA V.

Grand Theft Auto: San Andreas

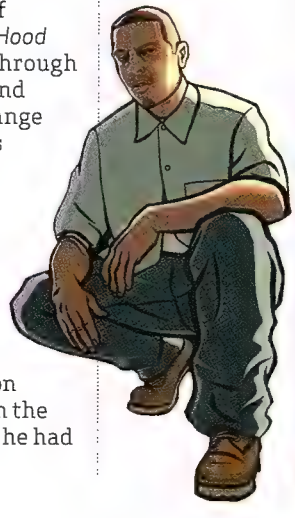
Andy Kelly revisits Rockstar's most ambitious open world.

You can fit San Andreas into *Grand Theft Auto V* several times over, yet the former still feels bigger. That's the most surprising takeaway from my time revisiting Rockstar's '90s crime epic, which has sold a staggering 21 million copies in its lifetime. Released on PC in 2005, a year after the PlayStation 2 version, it's a massive step up from the previous game, *Vice City*, in pretty much every respect.

In the early-to-mid 2000s you couldn't move for GTA clones: *True Crime*, *The Getaway*, *Scarface: The World is Yours*, *Saints Row*. But while these games were largely, or entirely, set in a single city, Rockstar used its unmatched financial might (and, some might say, hubris) to take things to the next level, presenting an entire state to cause mayhem in. California analogue San Andreas contains acres of country, a desert, and three cities: Los Santos, San Fierro, and Las Venturas.

The first 15 hours of San Andreas take place in Los Santos, Rockstar's satirical recreation of 1990s Los Angeles. This is not LA as it really was, but an exaggerated version of the city viewed through the lens of movies such as *Boyz N The Hood* and *Menace II Society*, and through the music of Snoop Dogg and NWA. It's all lowriders, orange sunsets, police helicopters scanning the streets with searchlights, and gangbangers swigging forties on the corner.

Protagonist Carl 'CJ' Johnson, an ex-gangster, returns home to Los Santos from Liberty City to bury his mother, but soon finds himself tangled up in the life of petty gang violence he had tried to leave behind.



To prevent you from immediately just leaving Los Santos and heading out to explore the rest of the state, corrupt cop Frank Tenpenny (played brilliantly by Samuel L Jackson) warns CJ that if he tries to skip town, the full weight of the law will come crashing down on him.

Of course, you're still going to try. The first time I played *San Andreas* I made a beeline straight for San Fierro, the game's version of San Francisco. But the moment you leave the boundaries of Los Santos you get a maximum wanted level, surviving which is pretty much impossible.

Today, open worlds rarely keep you contained in one part of the map – and certainly not for as long as San Andreas does. But for a game this size I think it's a good idea.

The map's desert region feels surprisingly big.

I'd love to see a modern *GTA* game set in Las Venturas

Flying above Los Santos in the twitchy Hydra fighter jet.

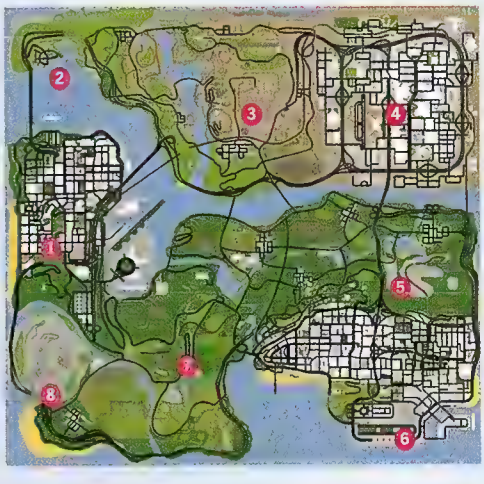
COUNTRY LIFE

When you finally finish the first act, you almost feel like you've been in Los Santos for the length of an entire *GTA* game. Which makes the moment when CJ is dumped in the countryside by Tenpenny even more exciting. Gone are the traffic-clogged streets and the endless sea of buildings. You're surrounded by trees, mountains, and rivers. Even the cars and pedestrians change to reflect your new surroundings, with the lowriders and gangsters replaced by hillbillies and trucks.

Rockstar pulls the same trick here, containing you in the countryside as you complete a series of missions for crazed bank robber Catalina and paranoid hippy The Truth. What I love about this section of the game is how, occasionally, you catch tantalising glimpses of San Fierro in the distance – most notably the Gant Bridge (Rockstar's take on the Golden Gate Bridge) and the Big Pointy Building, a parody of the Transamerica Pyramid. The game seems impossibly big at times.

STATE OF PLAY

A guide to the state of San Andreas



1 SAN FIERRO Rockstar's version of San Francisco. Landmarks include San Fierro Bay, the Gant Bridge, and the Big Pointy Building. There are a lot of hills in the city and the weather is often rainy.

2 BAYSIDE Cross the Gant Bridge from San Fierro and you'll end up in Bayside, a small town modelled after Marin County. Alas, other than the Bayside Marina, there isn't much of note to find here.

3 BONE COUNTY The largest continuous landmass in San Andreas. Here you'll find the Sherman Dam, a few small desert towns, and Area 69, a heavily guarded military base where you can steal a jetpack.

4 LAS VENTURAS Rockstar's take on Las Vegas. Like its real-world counterpart it's a city of sin, with a number of large casinos including the Four Dragons, Caligula's Palace, and the, er, Clown's Pocket.

5 RED COUNTY A rugged rural area featuring rivers, valleys, farms, and forests. Locations include Hilltop Farm, from which you can see both Los Santos and Las Venturas if the weather is clear enough.

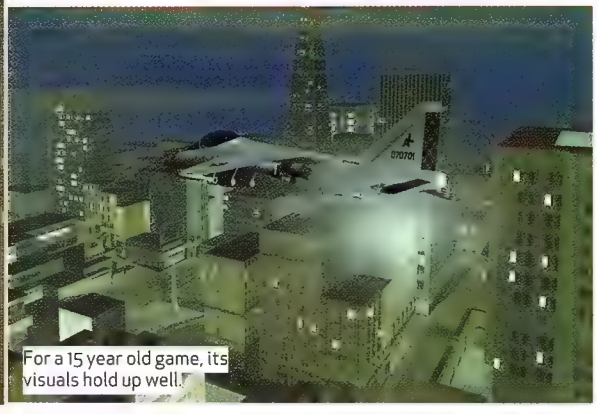
6 LOS SANTOS Rockstar's first parody of Los Angeles. Although not quite as detailed as its *GTA V* cousin, it still features many of the same landmarks, including the famous Vinewood sign and Grove Street.

7 FLINT COUNTY A forested region lying west of Los Santos and the least populated part of the state. There are no towns, making it the perfect place to hide away from the searching eyes of the law.

8 WHETSTONE In this rustic, tree-lined rural region you'll find the small town of Angel Pine and the colossal Mount Chiliad towering over it, which planes seem to crash into at an alarming rate.

Los Santos is the most detailed of the three cities.

Grove Street is your home in the first act of the game.


For a 15 year old game, its visuals hold up well.

SHORT ORDER

Playing *San Andreas* today, there's a sense Rockstar bit off more than it could chew. The game's draw distance is incredibly short, with a huge amount of pop-in, which was presumably the only way they could get the thing running on the hardware of the time.

There's also a noticeable drop in fidelity once you leave Los Santos, with San Fierro, and especially Las Venturas, feeling a little sparse and lifeless compared to the smaller cities from the previous 3D-era games.

But it feels massive, which I think is a combination of that draw distance obscuring the view ahead, and also the sheer amount of relatively empty space on the map. The countryside and desert in San Andreas seem genuinely barren and remote, while the rural areas in *Grand Theft Auto V* never feel totally isolated from the busier parts of the map. When you're riding through the desert west of Las Venturas, or the rugged rural expanse of Red County, you feel totally disconnected from civilisation, which adds to its sense of scale.

San Andreas is a highly moddable game, and it's possible to massively expand the draw distance in the PC version. But this removes that illusion of size, especially when you can see all three cities from one high vantage point. If you want to explore the map with a little more visual fidelity, a mod that transplants the entirety of San Andreas into *GTA IV* is available, although the clash of modern lighting and old school geometry is a little jarring to look at.

When CJ eventually reaches San Fierro, the look, feel, and tone of the game changes dramatically. The warm haze of Los Santos is replaced by a cold, blue-tinged colour palette, rain, and fog, and CJ gets involved with the Triads, street racing, and buying property. This variety is one of *San Andreas'* strong points, although the story does lose some steam here. Rockstar is generally very good at telling long, compelling stories that take place across

CUT IT OUT

Last minute changes to San Andreas

Despite its massive size, a lot of content was cut from *San Andreas* before release. Famously, a skateboard was supposed to be in the game, but was removed for unknown reasons. Animations and images for the board can still be found in the game files. Animals were also supposed to feature, roaming the countryside. The models are still in the game data, but they were never implemented. And it was reported that CJ would have been able to rob stores in an earlier version of the game. You can find an exhaustive list of cut content on **grandtheftwiki.com**.

You can see traces of *GTA V*'s Los Santos in *San Andreas*.

vast maps, but in *San Andreas* there are several points where the narrative sags and interest wanes.

But by the time CJ hits the Last Venturas strip, things gear up to the point where *San Andreas* feels more like a *James Bond* game. From that first bicycle ride through downtown Los Santos to jumping out of planes and robbing casinos, the classic GTA rags-to-riches story is at its most heightened and absurd here. When *GTA IV* opted for a more subdued, grounded story, fans often cried out for a return to the over-the-top action of *San Andreas* – a request fulfilled by its excellent *Ballad of Gay Tony* DLC, which restored some of that frivolity.

The story comes full circle as CJ returns to Los Santos to settle the score with his treacherous former allies, now packing a massive arsenal of weapons and huge amounts of cash. It's fun to see CJ grow from the broke, skinny kid in a tank-top to the tattooed, muscular, jewellery-laden crime boss he ultimately becomes.

Of course, his appearance is completely up to you. I know someone who finished *San Andreas* and never changed his clothes, hair, or body at all, apart from when a mission required it. I must have spent at least ten hours of my total playtime getting my CJ looking as cool as possible.

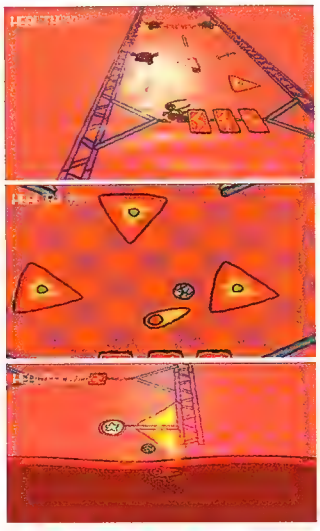
MISSION CONTROL

San Andreas is difficult to play nowadays. The world is still fun to explore, but the missions themselves haven't aged well at all. The shooting is clunky, the driving feels twitchy and weightless, and it's punishingly difficult – especially in the final act. And the less said about those tedious RC missions given by San Fierro nerd Zero (voiced by David 'Tobias Fünke' Cross) the better. Honestly, if you feel the need to return to the state of San Andreas, just download a completed save file and enjoy exploring the world without any hassle.

I don't think even Rockstar could make anything with this level of scope today. With the fidelity expected of a modern game, an open world with three distinct cities would be a tall order. Its most recent, *Red Dead Redemption 2*, is its biggest yet, but benefits from being set in a time when much of the United States was countryside. This makes *San Andreas* something of a one off. A snapshot of Rockstar at its most brash, bold, and ambitious, showing the pretenders that they were still the king of the open-world crime epic.

Vice City is arguably a better, tighter game, but this was a fine final chapter for GTA's all-conquering PlayStation era. It was also one of the first worlds that was so big it generated its own mythology, inside and outside of the game. Whether it was bigfoot, UFOs, ghost cars, or chainsaw killers, an entire community emerged dedicated to documenting and discovering the weird stuff Rockstar hid in its world. I myself saw a UFO in *San Andreas*. It was hovering over a bridge in the countryside.

Then it zipped off when I approached. It could've been a glitch, but I want to believe. ■



Mr Flipper

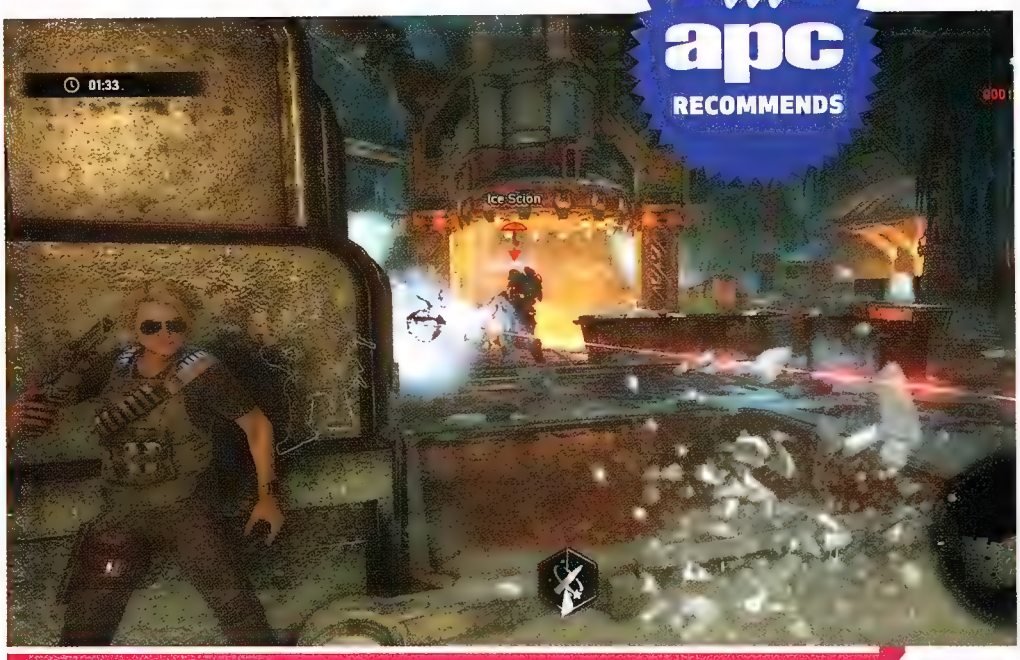
Bizarre pinball madness.

FREE | SNACKYCACTUS.ITCH.IO/MR-FLIPPER | BROWSER

It's a pinball game, except it isn't. You're the titular Mr Flipper, a sentient flipper who, at the touch of a button, can walk around. Your ultimate goal is not to set a high score, but merely to transport a single ball to the top of a vertiginous, scrolling pinball table. This is easier said than done. Obstacles are numerous, including enemies determined to munch the ball, the inexorable pull of pesky gravity, and a steadily rising pool of lava that will completely destroy the ball if it's left too long within.

In the traditional pinball style, you flip the ball upwards, before quickly upping sticks and chasing it around the board. If you're fast, and skilful enough, you can intercept it before it falls, and then slowly – frustratingly slowly – shepherd it up the board. You probably won't succeed, because damn this is difficult. It will ultimately be up to you, and your patience level, whether you stick with *Mr Flipper*, but it was hard to stay angry at this refreshingly bonkers pinball game. ■ Phil Iwaniuk

★★★☆☆



apc RECOMMENDS

$82 | GEARS5.COM | PC, XB1

Gears 5

Three years after the last installment, *Gears 5* finds a new voice amid time-honoured mechanics.

The fundamentals of the *Gears* series are a tried-and-tested cover shooting formula that's still enjoyable, six games on. The *Metal Slug*-style active reload, which gives your weapon a boost when you time your reload perfectly, still excites on a primal level, adding an extra wrinkle and a chance to feel adept where most games are happy to have you sit passively and do the reloading for you. Familiar, yes, but fun.

What stops the fatigue from setting in is, as ever, *Gears*' knack for throwing you into Hollywood set-pieces with just the right regularity. It knows when to let you you bask in the perfectly teed-up moment where you only need squeeze the trigger to save the day in a confetti cloud of bombast. And the answer, obviously, is: often. As for what's changed in that winning mechanical formula, it's all manifested in Jack. A surprisingly endearing support droid, he's there to revive downed party members, flashbang enemies, collect ammo and ping enemies. He even has a skill tree.

This is the most sophisticated and involving *Gears* title so far. And yet it still somehow feels lacking in substance, as though once you put down the controller there's very little about it that left an imprint. It's the kind of game that occupies you in the moment, but never pops into your head when people start talking about the best games of the year. Or, indeed, at all after you hit 'Quit Game'.

That boils down to two distinct facets of *Gears 5*: one, that the writing might offer more subtlety and humour than before, but still feels clichéd next to its contemporaries. And two: although there are new elements to the *Gears* formula, they're not new to the player. Which means *Gears 5* is what *Gears* has always been: deeply capable, eminently enjoyable and occasionally spectacular. The big difference this time around is that you know you're laughing along with the script, not at it. ■ Phil Iwaniuk

Verdict

A polished campaign with stalwart PvE and PvP modes refine the formula.

★★★★☆

$35.95 | CRYINGSUNS.COM | PC, MAC

Crying Suns

Flying in the shadow of FTL.

Crying Suns is both a good strategy game and a bad roguelike. It walks and talks like *FTL*, the indie hit that directly inspired it, but ultimately fails to mimic the endless replayability and daunting challenge that makes *FTL* so enchanting. Like *FTL*, I captain a spaceship through a randomly generated gauntlet of solar systems trying to keep my crew alive while navigating increasingly difficult encounters with the local populous. But where *FTL* gave these decisions as little narrative dressing as possible, *Crying Suns* creates a grim and vivid world that tees up an ambitious story.

Crying Suns' setting is fun to discover because it's so meticulously thought out and grandiose. Transcendent robo-gods and 800-year-old emperors juxtaposed with an intimate tale of friendship and betrayal make for genuinely a good science fiction plot.

Layers of this world are revealed through random encounters that happen as I travel from one solar system to the next. Each beat involves a decision that will either reward resources to upgrade my ship or leave me in a significantly worse for wear.

Combat plays out on a grid flanked by my and the enemy battleship. Between volleys from our main weapon systems, squadrons of fighters take the field to battle one another in a constant ebb and flow that's chaotic and tense. Managing cooldown timers is key, so if I throw everything I have at the enemy ship in an all-out assault and don't finish it off, I leave myself vulnerable to attack while my weapons and fighter squadrons recharge.

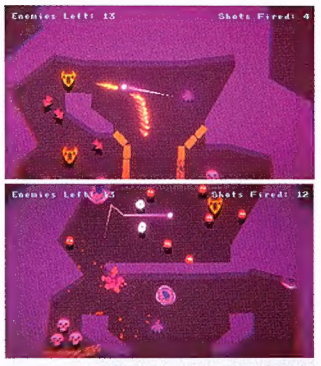
It's a great system that makes each boss fight a gruelling, merciless war of attrition. But *Crying Suns*' regular battles are rarely ever as tough – even if I go looking for trouble. With excellent storytelling and worldbuilding, *Crying Suns* is a good strategy game with some chaotic combat that ultimately feels a little too easy.

■ Steven Messner

Verdict

A little repetitive and easy but the story and combat are a blast.

★★★★☆



Goreball

The gore's in your court in this puzzler.

FREE | CHAOCLYPSE.ITCH.IO/GOREBALL | BROWSER

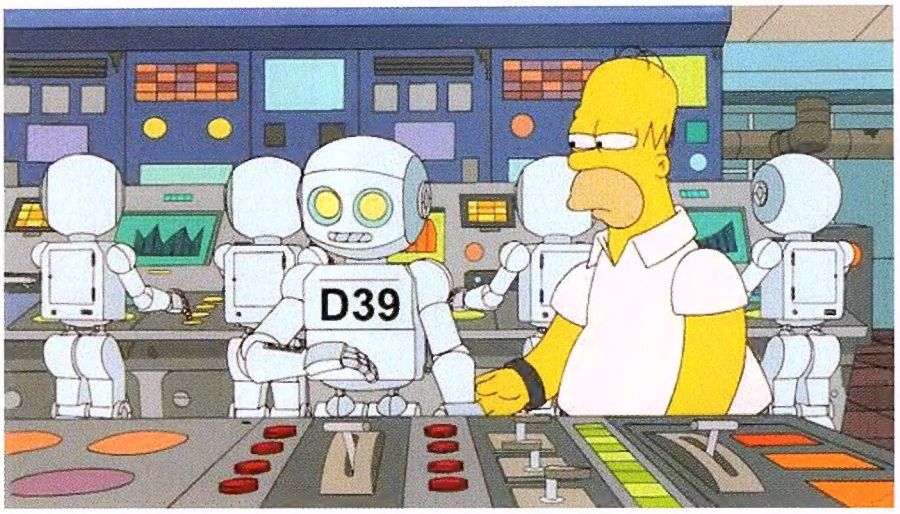
Imagine *Hotline Miami*, but with one bouncy ball instead of a variety of weaponry, and you're pretty close to this satisfying ping-'em-up. Each of the handful of levels is full of simplistic enemies who will swarm towards you when you wander too near. To progress you'll need to dispatch every one of them, with the only weapon at your disposal being a ridiculously boingy beach ball that will rebound hither and thither, exploding whatever monster that happens to be in its way.

There's a satisfying amount of screenshake, a nicely measured cocktail of velocity and inertia in the physics system, and those requisite little explosions of pixel confetti, to reward the player after each defeated enemy. Basically, *Goreball* feels great to play, to control from moment to moment.

Goreball is a brief game, and one that bafflingly introduces, then waves goodbye to, a potentially exciting mechanic in its very last stage. (Namely, a block of jelly-like slime with additionally bouncy properties.) However, it left me wanting more – and how many games can you say that about? ■ Phil Iwaniuk

★★★½☆

» JOEL BURGESS REPORTS ON THE UNUSUAL SIDE OF TECH NEWS.



Bots are bad for bonuses says San Fran. bank

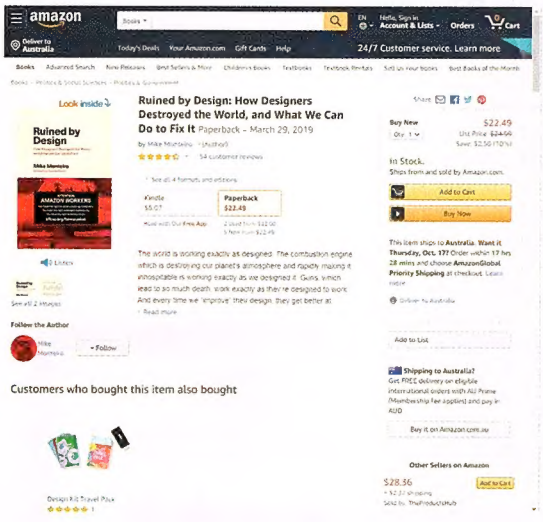
They might not be taking your jobs, but they're pinching your pay rise.

While US workers are apparently becoming more productive, there hasn't been a pay increase to reflect this transition and the Federal Reserve Bank of San Francisco is blaming robots. In an Economic Letter by Sylvain Leduc and Zheng Liu on behalf of the FRBSF published in September, they suggest that even though robot uptake isn't taking jobs directly at an alarming rate, yet it is giving employers leverage to keep wage-growth down. Some proponents are taking this as support for the need to establish a universal basic income provided by the government, with American Presidential candidates like Andrew Yang using this policy as an election centrepiece.

Amazon duped into distributing pro-union encouragement

AUTHOR SNEAKS CONTRABAND UNION MESSAGE ONTO COVER FOR AMAZON WORKERS TO SEE.

Mike Monterio is the author of the book *Ruined by Design*, which explores the craftsmanship of today's most destructive technologies according to a blurb on its Amazon marketplace page... a blurb that sits right next to a call to arms for an Amazon worker union. On the cover, clearly visible for any Amazon picker/packer to see, reads: "Attention Amazon Workers, You have the right to decent working conditions ... to bargain collectively ... to form a union." Since we are aware of Amazon's 'not neutral' position on employee unions, we expect that the company is yet to root out the hidden message, but the company could also just be banking on the fact that its employees barely have enough time to pack books, let alone read them.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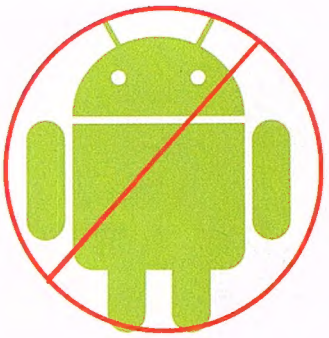


Angry mob wants Windows to change its Surface Duo

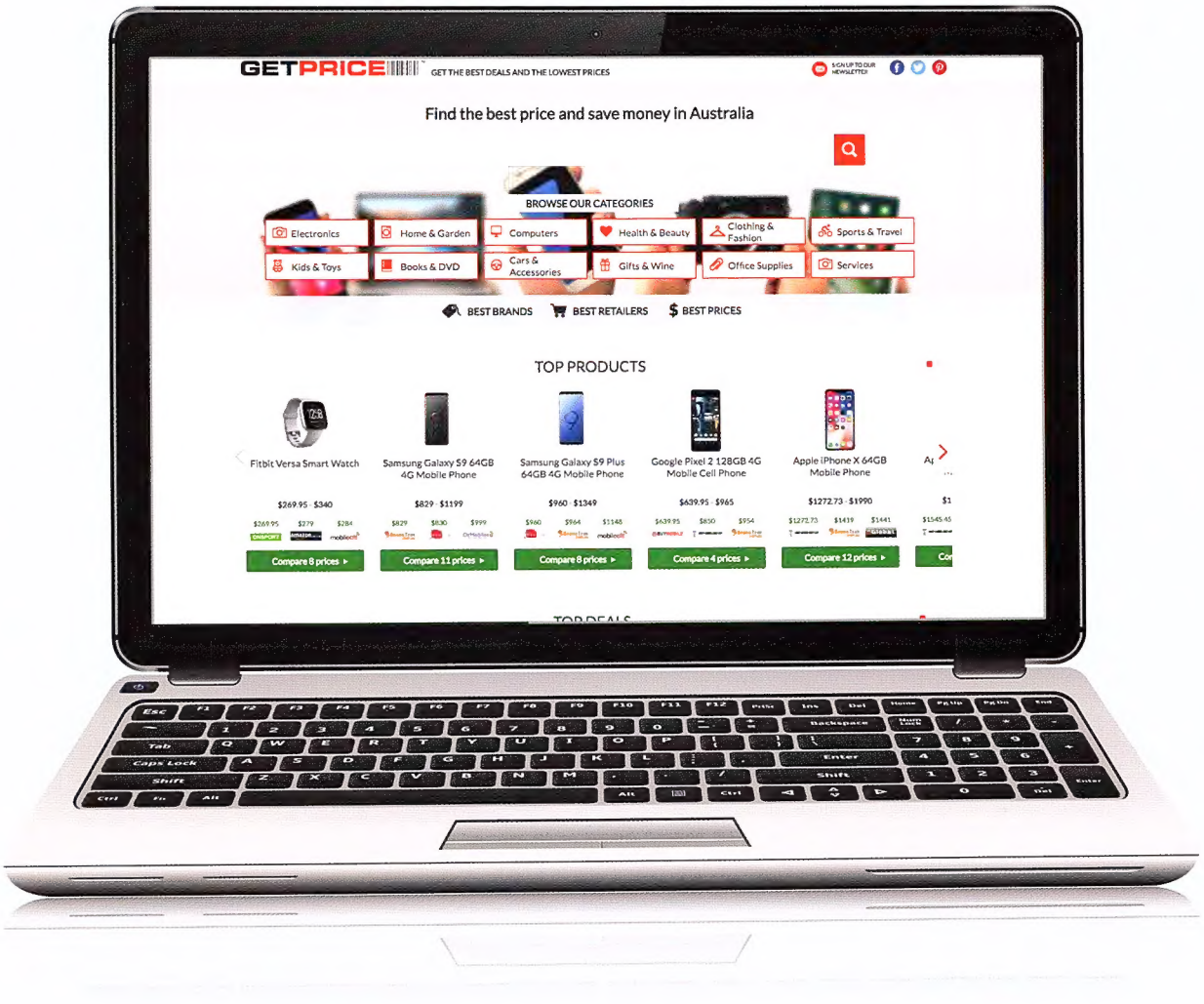
WINDOWS HAS SPARKED A NEW LOVE TRIANGLE BETWEEN DEVELOPERS AND TABLET OSS.

Just a day after Microsoft revealed its Surface Duo folding tablet for the first time, there was already a 1,500 strong Change.org petition for Microsoft to change it. The angry (and efficient) mob seems to be rallying around the idea that instead of running Android, the Surface Duo folding tablet should instead use Windows 10x OS. The reasoning is that there are some developers that want to make Universal Windows Platform software for small form factor devices. The trouble is that Windows already did that with Windows 10 Mobile and while there were plenty of developers making apps, the platform couldn't compete with Android's back-catalogue and established developer support.

MacOS Catilina update breaks some 32-bit eggs

THE LIST OF PEOPLE THAT THE MACOS CATILINA UPDATE IS NOT FOR IS PERHAPS LONGER THAN THE OTHER ONE.

MacOS is a great update for anyone who doesn't use Photoshop, Lightroom or iTunes. It's also fine for anyone who isn't a DJ, or those who would like to keep existing music databases in an XML format. If you happen to have a copy of Microsoft Office for Mac older than 2016 or you would like to continue playing your copy of *Assassin's Creed 2*, *Civilization IV*, *COD: Modern Warfare 3*, *Diablo II*, *Doom 3*, *GTA: San Andreas*, *Half-Life 2*, *Hearthstone*, *Portal 2* or *Starcraft*, then the Catilina update is also definitely not for you. So while we're assuming that there are at least a few people whose Apple-built software will play nice with all of their other 'current' Apple devices running the latest Apple OSs, we can't help but feel that that group is still a little small. ■



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- 1 x GbE LAN port
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